MARINE REVIEW

Entered at Cleveland Post Office as Second-class Mail Matter.

VOL. XXIII. Published every Thursday at 418-19 Perry-Payne Bldg., by the Marine Review Pub. Co. CLEVELAND, O., JUNE 6, 1901. Subscription $3.00 a year. Foreign $4 50 a year. No. 23

A GREAT STEAMBOAT RACE.

THE CITY OF ERIE IN A RACE OF NEARLY 100 MILES BEATS THE TASHMOO BY ONLY 45 SECONDS—A CONTEST DELIBERATELY PLANNED AND FULLY CARRIED OUT.

The race, or rather the contest of speed, between the side-wheel passenger steamers Tashmoo and the City of Erie on Tuesday was doubtless the most interesting event that has ever been held on the great lakes. It is probably the only time in the history of lake navigation when two great steamers have deliberately set out to determine the question of speed supremacy. There have been other races, entered into upon the spur of occasion, but there has been none deliberately arranged for in advance. The result of the race is the indisputable fact that the City of Erie is the fastest boat on fresh water. Under fair conditions and with plenty of water beneath her the Tashmoo can never hope to beat the City of Erie. It was only when the Erie was under disadvantage in shoal water that the Tashmoo gained upon her. In a shoal strip off Fairport the Erie increased her number of revolutions to 34¼, which was the maximum for the entire trip, but her slippage was so great that she made less than 21 miles an hour. Had the shoal water continued much longer the Tashmoo would have beaten her, for in the brief time in which it obtained she made up the distance lost in crossing the line behind the Erie and placed her nose about half a length ahead of her contestant. This lead, however, she could not hold when the Erie again struck deep water. Supt. C. B. Calder of the Detroit Ship Building Co. estimated the loss of distance to the Erie by reason of the shoal water at half a mile; and Mr. W. H. Fletcher of the W. & A. Fletcher Co., which built the engines of the Erie, estimated the loss in time at three minutes. The Erie, to use her power to full advantage, needs 100 ft. of water under her; off Fairport she had only seven fathoms.

Mr. Stevenson Taylor, engineer of the W. & A. Fletcher Co., New York, said that if the question of supremacy of speed between the Tashmoo and Erie was submitted to any naval architect prior to the race he would unhesitatingly choose the Tashmoo. She is a vessel 322 ft. in length, 37 ft. beam, 1,200 tons displacement and of about 3,000 H.P. The Erie is a vessel 324 ft. in length, 43 ft. beam, 2,450 tons displacement and of about 6,000 H.P. The Tashmoo is sharp and yacht-like in build, stripped to a skeleton and looks like a racing machine; the Erie, though a graceful ship, has fuller lines owing to her greater beam. The Tashmoo on the actual run had about one-half the displacement and more than half the engine power of the Erie. Therefore, says Mr. Taylor, any naval architect would have chosen the Tashmoo. It will be noted later in this article that the figures regarding horse power are supplemented by actual figures as to power developed in the contest.

What is the lesson of the race? Mr. Taylor replied instantly that the Erie had the better application of power. Would Howden draft on the Tashmoo have altered the result? Mr. Taylor replied at once that had the Tashmoo been equipped with a plain beam engine, supplemented with forced draft she would have generated 1,000 more horse power and would have run away from the Erie. He added a moment later, however, that with her triple expansion inclined engine forced draft would have been of no avail as she was limited to the capacity of her high pressure cylinder. That being full all the time no more could be expected of her. She carried all the time all the steam that she could use. It may be well to note, in connection with these few remarks from Mr. Taylor, that he is, of course, especially interested in the beam engine, for the manufacture of which his firm is known all over the country.

The Erie crossed the line off Cleveland at 9:38:56 o'clock and the Tashmoo 35 seconds later. When the starting gun was fired both vessels were lying motionless within half a mile of the line. The greatest surprise of all was the ease with which the Erie got under way. No one expected her to cross the line first—except Chief Engineer Rendall, and he was confident that she could get under full headway within the distance. For this extraordinary performance the amateur crew of the Erie raised a purse of $100 and gave it to Rendall. The Erie maintained her lead until Fairport was reached, when she ran into shoal water and pounded. The outer course would have been the better one for the Erie but the Tashmoo won it on the toss. The Erie regained her lead when she reached deep water and held it to the finish. It was common report that each vessel was holding something in reserve for the last few miles, but this was erroneous. Both were all in at the start and held nothing in reserve. They never varied at any time more than three or four lengths.

The singular part of the race was that it was more exciting to those who were not on board than it was to those who were on board. In order not to disturb the trim of the ship the passenger crew were not permitted on deck but were locked in the cabin with even the windows closed. They consequently viewed the race with their noses glued against the glass and at a considerable altitude from the water, which, of course, did not permit of any adequate comprehension of the speed at which they were traveling. There being much at stake this regulation was absolutely necessary, but a few embryotic newspaper reporters, with the mother's milk still oozing from their mouths, thought it a most outrageous curtailment of their liberties and drew up and signed a formal protest against the management of the boat. Maybe it was published in some newspapers and maybe it was not. All of them at least took copies of it.

The Erie crossed the finishing line at 1:57:5 o'clock, having made the trip in 4 hours, 19 minutes and 9 seconds. The Tashmoo crossed 1 minute and 20 seconds later. Deducting the 35 seconds start which the Erie had in crossing the starting line ahead of the Tashmoo, the actual difference in time between the two vessels was 45 seconds.

It was a perfect Tashmoo day. The sea was as glass. Not a breath of air rippled it. The Tashmoo had the outer course and all the advantage of weather and water. She was primed for a race. She was scraped and polished to the pink of perfection. She was, indeed, as beautiful a picture as one could hope to see in a world of oceans and was in as fine a fettle as some well-groomed and splendid animal. The Erie, on the other hand, had rested but one hour from the common drudgery of her freight business. She discharged her cargo and went out as she was. She had not been scraped, nor were her boilers clean, and yet she tore through the water and snatched a race from a racer. The result of the Erie's performance, as computed by Mr. Taylor, is as follows:

Distance, 96 miles; time, 4 hours 19 minutes and 9 seconds; speed, 22.23 miles per hour; average steam pressure, 118 lbs.; maximum steam pressure, 120 lbs.; minimum steam pressure, 112 lbs.; revolutions, 33¼; maximum revolutions, 34¼; displacement, 2,450 tons; horse power, 5,658; maximum speed, 22⅜ miles; minimum speed, 21½ miles; mean speed, 21.764 miles. Mr. Taylor had estimated prior to the race that the Erie's time would be 4 hours and 21 minutes. He did not think that she could possibly make it in any less.

The figures of Mr. C. B. Calder, who was on the boat on behalf of the ship builders, do not quite agree with Mr. Taylor's. He figures the distance at 94 miles and the speed at 21.76 miles. The revolutions were 33¼ and the total number during the entire trip was 8,646. He insists that at no time did the boats make 22 miles. The Erie was drawing 9 ft. 9 in. forward and 10 ft. 10 in. aft. The dip of wheels was 5 ft. 2 in. and she carried sufficient freight to give her a displacement of 2,450 tons, this displacement being in order to permit her to use her power. The slippage of the wheels was 32.76 per cent. Mr. Calder telegraphed the Review on Wednesday morning that the Erie's horse power during the race was 6,800 and the Tashmoo's 3,200.

"Both boats have exceeded our expectations," said Mr. Calder. "They were both built for 20-mile boats and have given a wonderful performance. I am here to get at the facts for we don't want to deceive ourselves. I don't believe the race teaches any lesson further than to demonstrate which is the faster boat. Howden draft would not have aided the Tashmoo for she had all the steam she could use. She was blowing off steam part of the time. I made the prediction before the race that neither boat would make a less speed than 21½ miles and that neither boat would reach 22 miles. I believe my figures are correct."

Mr. W. H. Fletcher, whose firm built the Erie's engines, was one of the most gratified men on board. "It is the most remarkable race I ever saw," said he. "In point of fact I think it is the most remarkable race that was ever run and I would go across the world to see another like it. It has been a gentlemen's race throughout. It started out without a hitch and it ended without interference. Never before have two vessels so deliberately set out to match their speed. Think of it. A perfect day, a lake like a pond, one vessel built for rough weather matching her speed against one built for smooth water and coming out ahead. The Erie is truly a very fast boat."

The Erie is equipped with a compound, vertical, jet condensing beam engine, high pressure cylinder 52 in. by 8 ft. stroke and low pressure 80 in. by 12 ft. stroke. Her feathering wheels are 28½ ft. diameter outside of buckets, and 12 ft. face. The Tashmoo's wheels are 22 ft. 4 in. Her maximum revolutions were 42 and the total number of turns 10,462.

A very large amount of money changed hands on the race. Much of it was placed in Cleveland after the arrival of the Tashmoo Monday evening, due to the fact that it had been proven during trials of the previous week that the Detroit boat had more power than was looked for by her designers and that her boilers would provide all the steam that would possibly be required and maintain full steam pressure on a long run. Three ship experts connected with the Detroit works are supposed to know most about the vessels. The men are Frank E. Kirby, designer of the best known side-wheel steamers of the lakes, and his two principal associates, C. B. Calder, superintendent, and A. George Mattsson, designing engineer. It is certain that these men expected on the day of the race a contest so even that they would say nothing that might be contributed as an opinion in favor of either vessel. Previous to the completion of preparations for the race it was thought that they looked upon the Erie as having some slight advantage in her great excess of power over the other vessel, but if such an opinion existed with them it was probably changed after the Tashmoo trials of last week to one of decided uncertainty regarding the outcome. Referring to these trials, Mr. Mattsson, who represented the ship building company on the Tashmoo, said:

"We had been getting only 2,700 H.P., extreme, out of the Tashmoo, until, in preparation for this contest, we changed the valve arrangement. We reduced the lap of the high pressure valve so as to get more steam into the high pressure cylinder and we also found that the safety valve had been set too light by about 10 lbs. These changes gave us 3,000 H.P. on a test made Decoration day. Then we turned our attention to the steam and found on a long run the next day that we had all the steam we needed and for almost any length of time."

It was the satisfaction with the condition of the ship that increased the enthusiasm of the Tashmoo's supporters when they set out for Cleveland. Disappointment was, of course, apparent after the race in everybody interested in the vessel, and there was some talk of defeat being due to a hot condenser and to a change in the trim of the vessel after a large quantity of coal had been used that was stored forward, but these statements did not come from the owners, who simply said they were fairly beaten in a fair race.

Sir Windsor Richards and Arthur Keen, two of the most prominent iron men of England, are in the United States inspecting the various steel plants. They were shown through the Bethlehem works at South Bethlehem, Pa., this week.

MODERN EQUIPMENT IN SHIP BUILDING.

The Fore River Ship & Engine Co. is completing, at its new ship building plant, Quincy, Mass., a set of forgings for the Old Dominion line steamship now under construction at Richmond, Va. The order comprises nineteen separate forgings, including line, propeller and thrust shafts, crank shafts, crank pins, piston and connecting rods, etc., all of mild steel, the total weight of rough forgings being approximately 18 tons. It is interesting to note that this company is the only ship building concern in this country equipped with facilities for producing, from the ingot, heavy crank shaft and similar forgings. The forge department of the Fore River works is equipped with a 20-ton steam hammer, in addition to a number of smaller hammers, and is served by two electric cranes, one having a capacity of 75 tons, the other of 25 tons. This equipment will render it practicable to forge from ingots 48 in. thick. With the single exception of a steam hammer of similar capacity, now in use at one of the large steel works, and not including hydraulic machines, it is believed that the facilities of the Fore River company are not excelled.

Aside from the production of heavy forgings from the ingot, the machine shop equipment, which makes it possible not only to forge but also to rough-machine the entire lot noted above in approximately ten days from receipt of order, is of interest. The entire machine shop installation is a notable example of the best practice in modern methods, and includes a crank shaft lathe of 72 in. swing, 20 ft. centers; two shafting lathes 60 in. swing, 60 ft. bed; two shafting lathes, 60 in. swing, 115 ft. bed; each driven by an electric motor geared direct to machine. In connection with the work of rough-machining these forgings, it may be stated that the diameter was reduced 1¾ in. at a single operation, the tool standing up well, and working dry without undue heating—in fact no discoloration of the chip was perceptible. The use of electricity as a motive power is general throughout the entire plant, the current being distributed from the company's power house. A majority of the machines are driven by individual motors, connected direct or by intermediate gear, though group driving is resorted to in the case of certain small tools.

In regard to the increase in productive capacity and the reduction in costs effected by this method, the facts have been particularly well summarized by Mr. William S. Aldrich in a paper entitled "Requirements of Electricity in Manufacturing Work," presented at the recent meeting of the American Society of Mechanical Engineers, held at Milwaukee, May 28 to 31. Mr. Aldrich states that "the resulting economy of production and the ability to fill orders promptly are all in favor of the electric system. It may be compared to skilled labor—high-priced, but very desirable from the standpoint of the economics of production. Few manufacturers still hesitate to employ high-priced skilled labor. Many more cling to antiquated methods of driving modern machinery operated by most skillful men. Today, therefore, this question assumes very different proportions. The discussion has been shifted to the field of manufacturing economics, involving considerations of maximum output with given equipment, floor space and working force. It is a question of accepting and filling orders or of losing the business to those manufacturers who can take them."

VIRGINIA TYPE OF BATTLESHIP COMMENDED.

The navy department has received an interesting report of the decisions arrived at by the naval board of experts recently in session at Newport, R. I. The board consists of Rear Admiral R. D. Evans, Naval Constructor D. W. Taylor, Capt. C. F. Goodrich, Commander Richard Wainright, Prof. P. R. Alger, U. S. N., Lieut. Com'dr J. B. Murdock and Lieut. S. E. W. Kittelle. A majority of the board has reported adversely to the construction of armored cruisers of the Maryland type and hold that one battleship of the Virginia type is worth two of the Maryland type. The board is unanimous in agreeing that more vessels of the Virginia type are needed by the United States navy. The Maryland is a sister ship to the Colorado and South Dakota. All three have been appropriated for by congress. The vessels are of 13,680 tons displacement, 502 ft. in length. They have two barbette turrets and two military masts. They will have a speed of 22 knots and will carry four 8-in. guns, fourteen 6-in. rapid-fire guns, two 3-in. rifles, eight 1-pounders and two submerged torpedo tubes. The battleship Virginia is a sister ship to the Rhode Island and has a displacement of 14,948 tons. A speed of 19 knots is demanded. The Virginia will have four 12-in. rifles, eight 8-in. rifles, and twelve 6-in. rifles in the main battery.

Prof. Alger reports that seven Marylands would have no chance in an action with four Virginias.

Lt. Com'dr Murdock thinks the Maryland is inferior to any armored cruiser ever constructed, and Lieut. Kittelle favors the construction of seven Virginias and no Marylands. Rear Admiral Evans advocates a type of battleship of 16 knots, 15,000 tons displacement, four 13-in. guns, and twelve 8-in. guns, without turrets.

WIRELESS TELEGRAPHY FROM A LIGHT-SHIP.

Nantucket island is again to be brought into prominence in the maritime world. Through the enterprise of the New York Herald, arrangements have been perfected for the establishment of a Marconi system of wireless telegraphy between the South Shoals light-ship and Sankaty head light-house for the purpose of reporting incoming and outgoing vessels. It is expected that this arrangement will give from 13 to 15 hours notice of the approach of ocean liners. The service will be in operation by about July 1. Commander A. P. Nazro, light-house inspector for the second district, has made a personal examination and reported favorably upon the plan and formal permission has been granted by the United States light-house board for the installation of the system upon the government property. The Nantucket south shoals light-ship is stationed farther from the shore than any other light-ship in the world, being anchored in about thirty fathoms of water, 43 miles from Sankaty head and 193 miles from Sandy Hook.

The torpedo boat Bailey, built by the Gas Engine & Power Co., and Charles L. Seabury & Co., Consolidated, Morris Heights, N. Y., has been accepted by the navy department.

SKETCH OF ROBERT MORAN.

The World's Work contains the following sketch of Robert Moran, of Moran Bros. & Co., ship builders of Seattle, Wash.:

"Robert Moran, scarcely yet in middle life, is perhaps the most notable case of individual achievement in the northwest. Born in New York, his childhood was hard and toilsome. At the age of fourteen he had left home, gone to Cincinnati and was doing a man's heavy work in rolling mills. Twelve hours over red hot iron and before the heat of blazing furnaces was not enough for this ambitious youth. He studied long hours after others slept. In 1874 he packed his few possessions and went to New York, there to pay his last cent for passage to San Francisco via Panama. Before he reached San Francisco an unknown philanthropist discovered that this boy of seventeen was broke, and after urging him to go to Seattle where the great city of the Pacific coast was one day to be, paid his fare. When Robert Moran reached Seattle early in 1875 he had not a penny. His education was such as a boy might gain who had worked in a rolling mill from the day he was old enough to run about. His first work in Seattle was performed for "Big Bill Gross," a negro restaurant keeper, to pay for food. Later he was hired as cook in a logging camp and as he had never cooked he was "fired" for the first and last time in his life. Gaining a job as fireman on one of the Puget Sound steamers he bought books and a drawing board and when he was not working he studied diligently. He was carried as assistant fireman on the old Cassiaire to the Sticksen river and there within a year by his superior nerve and coolness in time of danger he was made chief engineer and pilot. Old timers tell how he stood seventy-two hours at his post, eating such food as was brought to him. The first money he could save went east and in due time his mother, his sisters and his brothers joined him in Seattle and within ten years Moran Bros. had the best machine shop in the northwest. There were many triumphs during those ten years; notable among them was his first contract from the government for the construction of great pumps at the then embryonic navy yard at Port Orchard. The officials passed him by, but he sought and impressed them with his force, went home, drafted and designed all night, and was on hand next day with figures that gained him $10,000 worth of work and the admiration of every man he met. Not a figure or design of his was changed, and he was on his feet. The great fire of 1889 when $12,000,000 worth of Seattle property went back to the elements brought out another trait in his character. He had meanwhile been made mayor and but a few days before he had collected thousands of dollars for the Johnstown sufferers. On June 6, 1889, he stood at his post in the center of the city fighting fire when word came that his own plant could be saved if he would go down there and direct operations. He refused. His duty was in the center of the city and there he remained while everything he owned was in flames. He was everywhere that night. He directed and controlled excited men. He preserved order and closed every saloon. At 4 o'clock on the morning of June 7, hatless, coatless, looking more like a black than a white man he stood on the ruins of his dearly-loved plant, chewed his cigar and reflected. Within an hour he had men at work building other foundations and at noon was back in the city presiding over a meeting that sent thousands so sorely needed in Seattle to Johnstown. That was his spirit and the spirit of Seattle. Without a dollar in the world he managed to rebuild that plant and the brothers had so prospered in 1896 as to build the torpedo boat Rowan and to exceed the speed required. What wonder they succeeded? Nothing could keep them down. The man who reached the Pacific coast a penniless boy, hardly able to read and write, is today a famous mathematician, and probably not a man living has a better knowledge of his profession."

SHARON STEEL CO.'S ORE SUPPLY.

A dispatch from Duluth says: "The Sharon Steel Co. will begin shipments of iron ore from its new Mesabi range mine late next month. It is expected that about 200,000 tons will be shipped this year. This mine was bought by the company about a year ago for $150,000. Explorations showed the price to be a bagatelle compared with the true value, and the money was quickly paid. Since then the company has been offered $750,000 and has refused to consider any price. The mine is being stripped of the overlying earth and will be mined open pit, but not by the steam shovel method, now so noted. The surface is too deep for that. It will be mined by the 'milling' process, which, while not as cheap as the steam shovel method, is more economical, per ton of product, than any other class of mining. As high as 80 tons have been produced in one day per man in the mine, which is a remarkable record. The Sharon mine is supposed to contain about 15,000,000 tons of Bessemer ore, and so far it is the only mine in its immediate vicinity, though the Minnesota Iron Co., the Lake Superior Consolidated, the Republic Iron & Steel Co. and the Union Steel Co. have close by properties known to contain ore. The ore of the Sharon will be shipped to Duluth under a traffic agreement with the J. J. Hill road which lasts as long as the mine exists. The Sharon was the first notable exemplification of a newly found geological fact, that ore exists in the Mesabi range under a rock called locally a 'taconite.'"

GREAT THINGS PREDICTED FOR MONTREAL.

Mr. Tarte, minister of public works in Canada, addressed the business men of Montreal last week and said that as soon as the St. Lawrence route was made right Montreal would have dozens of elevators like Buffalo's. This would be necessary when shippers began to transport by the St. Lawrence route a good proportion of the 40,000,000 tons of freight tributary to the great lakes, and for which Montreal was the natural outlet. The Port Colborne works, Mr. Tarte announced, would be completed in two seasons, and the government was about to undertake important works at Georgian bay and the French river. Mr. Tarte pointed out that there were no Canadian boats to carry any increase of traffic, and the business should not be allowed to pass into the hands of the Americans. Mr. Tarte also announced that the Great Northern railway would soon enter Montreal. He favored free canals and a free port at Montreal. The minister also announced that at the next session of parliament he would ask for money to build a large dry dock at Montreal.

LARGE BALANCED SECTIONAL DRY DOCK.

William T. Donnelly, who was in charge of the construction of a sectional floating dry dock of 10,000 tons lifting capacity at the dock yard of Messrs. Tietjen & Lang, New York, described the work in a recent number of the Engineering News. The dock is capable of handling vessels of 500 ft. length. Mr. Donnelly's description is as follows:

The Lang balanced sectional dry dock is composed of five sections, each 110 ft. 10 in. wide, and 80 ft. long. When coupled together they are separated by 20 in. and the section at each end has an overhang of 30 ft., making an over all length of 466 ft. 6 in. The depth at the center is 13 ft. 6 in., and at the waterways 12 ft. 6 in. The height of the wings is 39 ft. 9 in. The draught of the dock, light, is approximately 4 ft. 6 in., the maximum draught which can be lifted 26 ft. and the maximum lifting power 10,000 tons. The available width between wings is 92 ft.

The pumping machinery consists of duplicate sets on opposite sides of the dock, each composed of two 125 H.P. vertical boilers, operating engines with cylinders 20 in. diameter and 24 in. stroke, and making 150 revolutions per minute. Each engine drives a line shaft, which runs the entire length of the dock. These operate six pumps on each side of each section, or a total of sixty pumps. The pumps are 16 in. square by 20 in. stroke, and as they are driven by a reduction gear of one to two from the engine shaft, they make seventy-five strokes per minute. This machinery is designed to pump the full capacity of the dock in 45 minutes. The sections are coupled together by what are known as locking logs, which connect the sections together through keepers. These logs are of oak, 40 ft. long and 24 by 28 in. in section.

The essential principle embodied in the Lang balanced sectional dry dock and that which has made a floating dock of this size possible, is the manner in which the sections are divided into water tight compartments. The separate sections in the previous sectional dry docks were without transverse bulkheads, and any inclination of a section in a longitudinal direction would cause the water to flow towards the lower end and increase the difficulty of the unbalanced condition. In the Lang dock this has been overcome by building two transverse bulkheads in each section and providing independent means for pumping each compartment. This results in giving to the sectional dry dock the desirable features of the present balanced dock, and at the same time retaining many desirable features of the sectional dock.

The choice of machinery for this class of dry dock involved the consideration of a great many questions, and results were only arrived at by a series of eliminations. We were fortunate in this instance in having the guidance of all that had been done in and about these waters, and the requirements or conditions that the machinery must meet have been pretty well threshed out. Simplicity and reliability are of the first importance, and economy or efficiency which more often heads the list in large engineering work, is here the last thing to be considered. When it is understood that the machinery at the most will be used but one or two hours in the twenty-four, and more often only once in several days, the small importance of steam economy is apparent. Therefore, in selecting the type of engine, we chose the simple, direct-acting, vertical engine of ample power and of great strength and solidity. The boiler question was limited to such types as could be handled in the extremely limited room on the top of each wing, and the upright type with vertical tubes and submerged steam dome was considered to meet the conditions most satisfactorily. The question of pumps is one that is very broad, and after going over the ground carefully, we became thoroughly convinced that that type of pump which has quite generally been used on these docks, and which the Tietjen & Lang Co. used on all of their other docks, possesses qualities of simplicity and durability that cannot be excelled by more modern and perhaps more mechanical appliances. This pump is a square wooden box made of 4 in. oak planking, 16 in. square inside, and about 14 ft. long, or reaching from the bottom of the dock up through the floor of the pump-well a short distance above the deck. There are two of these pumps for every transverse compartment of the dock. They are single acting and each is provided with a foot valve near the bottom of the pump barrel. The foot valve and plunger are made from the same pattern, and are practically gridiron valves, with a rubber diaphragm. The foot valves drop into a taper seat near the bottom of the pump barrel, and the plunger is attached to the lower end of the pump rod. The packing of the plunger is of 4 in. leather belting secured at its lower edge by rivets and free at its upper edge to press against the pump barrel. These pumps have been found to have exceedingly long life, and the parts to be replaced in case of wear or breakage are very simple and inexpensive. The pump rods are connected to a rocker arm, and on one end of this rocker arm is attached a connecting rod operated by a crank on the end of a shaft driven from the main line shaft. The pump rods are of 4 in. I-beam, and the connecting rods of 5 in. I-beam. The boxes at the upper end of the pump rod and each end of the connecting rod are of bronze and are duplicates. The crank shaft and line shaft at the point where the reduction of speed is effected are carried in two stands, and the bearings for both line shaft and countershaft are made from the same pattern, and by means of these stands the distances between centers of the gear are accurately maintained. The object of referring to these details is to show the effort which was made to effect the greatest possible duplication of parts. In proportioning the machinery for the work to be done a large factor of safety was used, as a break in any of the machinery during the lifting of a vessel might involve a loss of much time, an item of the greatest value in the case of large vessels. The great duplication of parts makes it possible to effect any repairs quickly and with very few parts on hand.

A special problem was involved in the transmission of power from one section to another. When it is understood that a section may have a relative movement only limited by the locking log, and that this movement may be in any direction, it will be apparent that the connection must be both a universal joint and a slip coupling; a universal joint, so that the shaft may turn when out of alignment, and a slip joint so that the sections at this point may come together and separate without interfering with the transmission of power. As the slip coupling must operate under the strains of power transmission, it is necessary to provide a thrust bearing to each section. This was accomplished by securing a flanged hub to the shaft and bolting securely to the top of the dock a cast-iron plate or shoe which engages the flange of the hub and prevents longitudinal movement of the shaft. The slip joint was made of a square shaft, and all the parts of this joint and the universal joint are of cast steel.

The flood gates of the dock have an opening 12 in. square, and the closing slide is made with a taper at each side of the back, so that when forced down by a rod it will be wedged tightly against its seat. The operating rod runs up through the side of the wing, and the gate is raised and lowered by a wheel operating a bronze nut on the upper end of the gate rod. In operating the dock, the engine and all the pumps are running all the time, and the desired lift to correspond to the weight of a vessel over any compartment of the dock is obtained by a greater or less closing of the floodgate corresponding to that compartment

In this class of docks (wing docks) the wings or sides have to be built high to admit of deep-draught vessels over the keel blocks, and to carry the large and heavy machinery used in pumping. Also sufficient displacement or bulk must be given to them to insure the stability of the dock and vessel. To overcome the buoyancy of the dock it is necessary to load it with stone ballast, which is placed in the wings, amounting to 5 tons per running foot, or 400 tons per section in the dock now under consideration. With these points in mind it may be seen that, starting with the dock down and a vessel over the keel blocks ready for docking, the sequence of conditions is about as follows: First, the interior and exterior levels of the water are about the same, as just enough ballast has been added to sink the dock to this level, and the dock is practically free from strains; second, the flood gates are closed and the pumps lower the interior level of the water, and the vessel is raised to a degree corresponding to the amount of water pumped out, but as the area of the wing is small relatively to the midship area of a vessel corresponding to the maximum lift of the dock, the drop of the interior level of the water will be much more rapid than the rise of the vessel and dock out of the water, and the difference will continue to increase until the wings are pumped out down to the level of the body of the dock, when it will be about 16 ft., which will correspond to a buoyancy or lifting power of 6 tons per running foot of the dock for each wing, or 18 tons for each wing per truss. The condition of the loaded truss would now be 36 tons concentrated load at the center and a counter strain of 18 tons at points about 7 ft. from each end. With the proportions of truss here used, this would give a maximum strain at the center of the lower chord of 72 tons. From this condition there will be a rapid change, as the lowering of the water in the interior of the dock will be over its entire area, and as this is much greater than the area of the water line of the ship, especially as the immersed body of the ship decreases rapidly per foot of elevation, the difference of the interior and exterior levels of the water will rapidly grow less, the ship and dock rising much faster than the level of the interior water is lowered. This change will continue until the dock is entirely pumped out, when, if the lift has been to the maximum capacity, the dock will be just clear of the water, and the load upon it will correspond to the amount of displacement pumped out between the interior and exterior levels of the water at this time, less that necessary to float the dock at this level.

AN OCEAN SERVICE DE LUXE!

The London Express prints a story that is at least interesting, no matter what may be said of it otherwise, regarding two great ships which Mr. Morgan has planned for the ocean ferry. They are to excel anything that has ever been seen on the water and will be to sea travel what the "limited train" is to the American railway. According to the Express story, an official of a leading American line who has been in consultation with Mr. Morgan at Aix-les-Bains says that he was allowed to see the plans for the two liners de luxe, which are to be constructed for the comfort of that class which does not have to consider money when luxurious living is concerned. In the first place, these boats, both of which will be five-day vessels, will carry none but first-class passengers. There will be no single cabins, but suites of apartments, consisting of parlor, bedroom, and tiled bathroom. There will be suites with more rooms, but the majority will have three. The suites will be furnished in the richest fashion and variously decorated. There will be color schemes to suit all fancies, and many styles of furniture will be represented. The passageways will be broad and well lighted.

The public rooms will be magnificent creations, decorated by famous artists. The dining room will have no long general tables, the arrangement being one of small tables, similar to that of the restaurant of the Hotel Ritz in Paris. Ingenious devices will be used to prevent upsets in stormy weather, and each table will have two attendants. A pleasant feature will be a grill room. A dairy will be maintained on board, ship quarters being provided, in the space usually devoted to steerage, for a small herd of Jerseys. Along with the cows there will be carried a number of hens. Thus the millionaire can have fresh milk and new laid eggs though 1,000 miles from land. The arrangements for providing and keeping food are perfection. The greatest novelty will be a cafe chantant, where an excellent entertainment will be given each evening, the intention being to engage high class artists. A theater supper will be served after the performance. There will be a gymnasium, a large library, a sun room, a full stocked conservatory to provide fresh flowers daily, a skilled medical staff, readers, stenographers, manicures, masseurs and special rooms for dogs. The cheapest passage will be £200.

A cablegram Wednesday to Charles Counselman of Chicago, who has built four steel steamers for a trial of through service between Chicago and European ports, announced the arrival at Hamburg of the first of the four vessels that passed down the St. Lawrence canals on the opening of lake navigation. The passage was one of thirty-five days, of which nineteen had been occupied traversing the great lakes and canals before leaving Quebec for the ocean voyage. The Northman, which is a steamer of 1,496 tons net, sailed from Chicago April 30 in command of Capt. Ross, with a general cargo. It sailed from Montreal May 17 and Quebec two days later, and on May 22 it sailed from Sydney, C. B., after coaling. The scheme of going through the canals was to give the vessel the maximum cargo to Buffalo, there partially unload, and then after passing through the canals, reload at Montreal. The round trip is expected to take sixty days.

NEW SHIP YARD ENTERPRISES.

In view of the activity that continues in ship building on the seaboard, it is not surprising that the projectors of another enterprise of this kind, involving an investment of about $3,000,000, are meeting with success and will probably announce shortly the completion of their plans. We refer to the proposed new works at Chester on the Delaware river. Names of the principals in this enterprise, which has been under way for some time past, are purposely withheld, and this is why the dispatches of the past week from Philadelphia have been so meager in detail, but the organization of the company is now so far advanced that a full announcement may be expected almost any day. The new plant will be very large and modern in every way. As it is generally understood that the Cramps, the Newport News Works, the Sparrow's Point yard and other large establishments have work enough to crowd them for nearly two years, and all of it of a kind irrespective of ships for the foreign trade, it would seem that there is room for the new concern, especially as there is still decided hope of legislation that will prompt the construction of vessels for over-sea commerce. The success of the New York Ship Building Co. (big new works at Camden, N. J.) in securing a long line of orders before a first ship had been built is an indication of what may be expected in ship building lines on the seaboard for some time to come. This company is working on orders for eight large steel merchant ships, regarding which announcements of sizes, names of owners, etc., has been made, and it is understood that they have recently closed contracts for two more large steamers, but the names of parties for whom these are to be built will be withheld for a short time.

The Holmes Ship Building Co., West Mystic, Conn., besides having a five-master on the stocks have just launched nine yachts of the one-design class for the Rhode Island yacht club. The yachts are all 28 ft. over all, 18 ft. on the water line, 9 ft. extreme beam with a draught of 2 ft. 8 in. They have a cast iron keel, weighing 1,300 lbs. The frames are of oak and the planking of cedar. They are rigged with main sail and jib.

A Tampa (Fla.) dispatch says that John W. Guider, formerly of New York, proposes to establish there a very large ship yard. He is said to have secured river front property formerly used by the West Coast Naval Stores Co., and he announces that he has orders for two vessels, a steamer and schooner, which will be put down at once, so as to have work under way while the yard is being developed.

The four-masted bark Lahaina was launched from the ship yard of W. A. Boole & Son, Oakland, Cal., recently. The vessel was built for Hind, Rolph & Co., San Francisco, and is 245 ft. in length and 41.6 ft. beam. The keel of a sister ship to the Lahaina will be laid immediately by the Booles.

The Penn Steel Casting & Machine Co., Chester, Pa., are furnishing the enormous casting required for the great ships for the American line building at Cramps and for the American-Hawaiian ships, building at the New York Ship Building Co.'s yard at Camden, N. J.

The New England Ship Building Co., Bath, Me., will build a four-masted wooden schooner for A. J. Hustin of Baltimore. The vessel will be 156 ft. long, 36 ft. beam and 13 ft. deep. This company a few days ago launched the four-masted schooner Springfield.

The five-masted schooner William Marston was launched from Stone's ways, North Beach, San Francisco, Cal., recently. She is intended for the sugar trade between Honolulu and San Francisco.

A four-masted schooner, the Ada F. Brown, was launched from Charles V. Minott's yard in Phippsburg last week. She is 221 ft. long, 41.5 ft. beam and 18.66 ft. deep.

NAVAL WAR COLLEGE FORMALLY OPENED.

The naval war college was formally opened during the present week and the speech of the occasion was made by Assistant Secretary of the Navy Hackett. It is a circumstance worthy of note that Rear Admiral Sampson was referred to as the distinguished chief of the squadron at Santiago and that the recognition received substantial applause. Mr. Hackett's address was as follows:

"Seventeen years have passed since the first steps were taken to bring into being an institution that should provide for the 'higher education' of officers of the navy. During its early struggle for existence, the naval war college met and dissipated that cloud of prejudices which is almost sure to envelop a project in its nature novel and experimental. The college has survived for the reason that faith has been kept with the promises of those who stood as its sponsors. You assemble here that you may engage in the task of educating yourselves, for this is a college without professor or text book. All are students. You are to learn something of naval tactics and naval strategy. You will listen to lectures upon naval history, upon international law and like topics; some of you will prepare and read papers dealing with naval campaigns; you will point out and discuss the causes of success or failure attending naval operations, of our own and other powers.

"But the unique feature of the course is what is known as 'the war game.' Here one finds out empirically into what sort of a situation he is likely to be precipitated in the event that war shall suddenly come upon us. It sets a man to thinking what he had better do about it. When an officer goes away at the end of a course he carries with him a new stock of ideas. Later, upon taking command of a ship, there would seem to be no reason why he may not improve the opportunity to impart some of these ideas to junior officers. In this way the influence of the naval war college may be exerted in numerous directions.

"The sinking of Cervera's fleet was not the execution of a plan suddenly inspired. On the contrary, that memorable July forenoon saw wrought out that which in its beginnings, at least, was rehearsed, so to speak, in these very halls. An incident that occurred not long after the close of the war serves to illustrate my meaning. Rear Admiral Sampson, happening to be here, saw suspended on the wall a large chart of the Cuban coast. It bore certain marks that denoted the movements of war vessels. The admiral took it to be a chart that had recently been prepared for the purpose of illustrating certain features of the Spanish war. It turned out, as a matter of fact, that he was looking at a working model that had been put to use two years before the war in the study of an imaginary campaign against Spain. So, too, the contingency of scouting in the West Indian waters during supposed hostilities with Spain had not been neglected. For the purpose two rooms were occupied. An officer in each room represented a contending force. Each started with a like knowledge of the number, character and the assumed disposition of the ships of the other. Each did the best he could to fix the whereabouts of his opponent. On a signal work was stopped and the officers prepared results. It is told of one accomplished commander whose ship did invaluable service as a scout on the Cuban coast, that while thus engaged he found the work strangely familiar, and said of it, 'why, it seems as though I am sure later on to hear Taylor's bell.'

"Another illustration of the benefits of the instruction here will, I think, interest you. You will recall the fact that during the Spanish war Rear Admiral Remey served on board the Lancaster, a station ship at Key West. The admiral was the center of communication between the navy department and our fleet in the West Indies. How well he performed the duty you need not be told. An officer of Admiral Remey's staff is quoted as having said of the work in the Admiral's office, that it was exactly like the work during one of the war college war games; and that no study could have better fitted one for the real thing.

"The United States in enlarging its borders and taking to itself foreign possessions has indeed assumed a grave responsibility. To the navy is largely due their acquisition. Upon the people of these distant islands we are conferring the blessings of good government. For their protection and welfare we shall continue to look, in a large measure, to the navy. Nor shall we be disappointed."

AROUND THE GREAT LAKES.

The Canadian Northern Railway Co. has started the construction of a terminal elevator at Port Arthur, which will have a capacity of 1,500,000 bushels. J. A. Jamieson is the contractor and it is planned to have the elevator in operation in time for the wheat crop this fall.

Reference was made in the last issue of the Review to the honorable and industrious life of Capt. Andrew Hackett, of Bois Blanc island, Detroit river, who was then at the point of death. Capt. Hackett died almost before the paragraph with reference to him was in type.

The Donnelly Salvage & Wrecking Co. of Kingston, Ont., succeeded, a few days ago, in releasing the barge Isabel Reid from the shoal in the rapids at Cardinal and the barge with her cargo of coal is now at Montreal. The Isabel Reid is one of the tow of the propeller L. S. Porter, which stranded some two weeks ago. The L. S. Porter, the Rob Roy and Isabel Reid have now been released. The barge Drake, another vessel of the tow, will also be released.

It is announced by the Canadian marine department that the light shown from the back range tower at Port Dalhousie, Lake Ontario entrance to the Welland canal, will be changed from fixed red to occulting white showing a bright light for 30 seconds, and eclipsed for 5 seconds alternately. The illuminating apparatus will be catoptric, and the illuminant electricity. In the event of the electric power at any time failing temporarily, a fixed red light will be shown as at present until the occulting light can again be put in operation. At the same time the illuminating apparatus in the front tower will be changed in character from catoptric to dioptric of the seventh order, and the illuminant from oil to electricity, but no change will be made in the characteristic of the light, which will remain fixed white as at present.

Canada's marine department makes this announcement in a printed circular: "An examination of Southeast shoal, off Point Pelee, Lake Erie, made by Mr. W. J. Stewart, D. G., surveying steamer Bayfield, and by the chief engineer of this department, shows that throughout its extent it consists of firm fine sand; no signs of rocky ground, as marked on charts made from latest surveys, or loose stones, could be found. The shoal is also making slightly to the south-westward. The same officers find that the schooner Specular, sunk last year east of Pelee island, has been broken up by the ice, and no wreckage could be found within 20 ft. of the surface. The wreck is in the same place as last year, and the keel, with probably some frames at the bow and stern, remains. Until the locality can be tested by sweeping the place is marked by a small black and white flag buoy. If, on sweeping, any timbers that would endanger a vessel are found, they will be marked by a black spar buoy."

There is a little more than cold business formality in an announcement just made by the B. Uhrig Fuel Co. of Chicago regarding its relations to the newly organized Milwaukee Western Fuel Co. Here it is: "We beg leave to announce that we have sold to the Milwaukee Western Fuel Co. our plants, business and good will, and as we are financially interested in the new company, we earnestly request a continuance to them of your valued patronage. The new company expect to retain the services of our salesmen, and your interests will be looked after with the same care and attention as in the past. While we feel a natural regret in giving up the old firm name, we wish all our friends to feel and know that it is a change in name only. We have made this change after long and careful consideration, and only because we believe the economies effected under the new arrangement, and the greater and better facilities we will have for serving you, will be of great advantage, both to you and to ourselves."

New vessels listed in the June supplement of the Inland Lloyd's Register are: steel steamer Mary C. Elphicke of 4,998 gross tons, valued at $275,000 and owned by the Federal Steamship Co., C. W. Elphicke of Chicago, manager; steel passenger steamer Iroquois, 798 gross tons, built by Craig Ship Building Co. of Toledo, owned by Arnold Transportation Co. of Mackinaw Island, Mich., and valued at $150,000; steel passenger steamer Ossian Bedell of 296 gross tons, owned by Ossian Bedell of Buffalo and valued at $25,000; steel freight steamer Kennebec of 2,183 gross tons, built by Jenks Ship Building Co. of Port Huron for Chesbrough Bros. of Detroit and valued at $145,000; Lehigh Valley line package freight steamer, Mauch Chunk, a vessel of about 6,000 tons carrying capacity, built by the Buffalo Dry Dock Co.; passenger and freight steamer Puritan of 1,052 gross tons, built by the Craig Ship Building Co. of Toledo for the Graham & Morton Transportation Co. of Chicago and valued at $175,000; freight steamer Uranus, one of the eight new steel ships of the J. C. Gilchrist fleet, Cleveland, valued at $205,000 and of 3,748 gross tons.

LAKE SHIP YARDS MAY AGAIN BE FILLED UP.

In view of the manner in which a late opening of navigation and continued prosperity in all steel and iron lines have upheld freights on the great lakes for another season, it would not be at all surprising to find the lake ship yards filled with work for 1902 before the present season is half over with. The ball was set rolling a few days ago when Capt. John Mitchell of Cleveland placed an order with the American Ship Building Co. for two freight steamers that are to cost something more than half a million dollars and which are to be ready for the opening of navigation next year. It is understood that officials of the big ship building organization have negotiations under way that are expected to result in an order for ten vessels that may be used in either lake or ocean traffic and that orders for two more large lake freighters, one of them for Drake & Maytham of Buffalo, are also near the closing point. The new Mitchell steamers will afford a special opportunity for comparisons between Howden and Ellis & Eaves systems of forced draft. Hulls of the new vessels are to be the same as those of the steamers Holden and Albright, built last winter for Mitchell interests, but engines and boilers are to be like those in the steamer Black, built by the Detroit Ship Building Co. It happens, therefore, that the new steamers will be practically the same dimensions as the Black, and with machinery the same the two systems of draft will be tried under equal conditions. The Black is looked upon as a very economical freighter. Dimensions of the new steamers are 416 ft. keel, 50 ft. beam and 28 ft. depth. The Black is of the same beam and depth and there is only 2 ft. difference in keel length. She is 414 ft. keel. Mr. W. Wallace, representing John Brown & Co., Ltd., of Sheffield, England, who control patents on the Ellis & Eaves draft, was in Cleveland when the contract for these two vessels was placed and is to take especial interest in their power equipment. The engines, alike to those of the steamer Black, are to have cylinders of 22, 35 and 58 in. diameter with 40 in. stroke; two Scotch boilers of 13 ft. 2 in. by 11 ft. 6 in.; steam pressure 170 lbs.

The steel steamer building in the Jenks ship yard at Port Huron for Capt. Samuel Neff of Milwaukee was launched Wednesday and christened C. S. Neff. This steamer is designed for the lumber and salt trade and is 212 ft. long, 38 ft. beam and 14 ft. deep. She has fore-and-aft compound engines.

PLEASING INCIDENT ABOARD THE ERIE.

A very pretty incident occurred on the City of Erie during the race with the Tashmoo on Tuesday last. Capt. William McKay, the dean of side-wheel captains, was aboard. It had been the custom of Com. George W. Gardner of Cleveland to take several trips during the year with Capt. McKay, no matter what his run might be, and at any rate to take one trip during the year. Twenty years ago Com. Gardner presented the captain with a gold badge, bearing the word "commander," the letters being cut out of solid gold. It was an exquisite bit of work, and the old captain wore it for years upon his cap. He said during the trip that it was the only bit of jewelry he ever possessed and that he prized it more highly than anything else. He wanted, however, now that he had retired from active service, to present it to Capt. Hugh McAlpin of the City of Erie. The presentation was made in the captain's office by Com. Gardner. Capt. McAlpine was taken entirely by surprise and responded in as few words as possible. After the presentation a number of stories of Capt. McKay's bravery were told. One of them, told by Com. Gardner, was particularly good.

"One Saturday afternoon," said Com. Gardner, "we were shipping a cargo to Buffalo. There was a terrible storm outside. We had just promoted a young fellow to captain, and I called him aside and told him that the trip was not a matter of life and death and that he had better wait until the storm abated. He was ambitious, however, to make a record and insisted upon going out, saying that he could land the cargo in Buffalo easily on Monday morning. He hadn't been out but a very few hours when I received word that a vessel was in distress off Euclid Creek and that the crew were lashed to the cross-trees. The vessel was rolling frightfully and the crew were being submerged half of the time. I made up my mind that that was our brig, the Sultan, and I went down to the river to see if I couldn't get some one to go out to help her. The only steamer in was the Northwest. I asked the captain if he would go out but he was afraid he would get stuck on the bar and declined. There was one tug near the government pier and I asked the captain of her if he wouldn't go out. He said that his insurance wasn't high enough. I asked him how much more he wanted and when he said $4,000 I volunteered to get it and to pay the premium on it and to go out with him. He then said that the sea was too high and that he wouldn't risk it. I had to wait then until 4 o'clock in the morning when the Detroit & Cleveland steamer came in. She stopped at the government pier, as was her custom then, to discharge freight. In a moment or two Capt. McKay came down on the dock. I related the circumstances to him. He didn't wait for me to ask him to go out but said very quietly: "I'll be ready to back out in three minutes." He then asked me if I had a sharp knife. I told him I would have one by the time the steamer reached the wreck. When we got to the wreck there was only one man lashed to the rigging left. The rest had been drowned. The captain said: "I am going to run her nose across her quarters, so you lean over and cut that man loose from the rigging. You'll have to work quick for I shall have to back out at once to save myself from being crushed." Well, he sent her bow over the boat and we cut the man loose. He was unconscious but we had some brandy on board and soon revived him. That is only one incident of Capt. McKay's bravery."

For the rescue of this man and for other gallant acts Capt. McKay was presented with a gold watch and chain, suitably inscribed, in October, 1864. He exhibited the watch to those present in the cabin and tears rolled down his cheeks as he listened to the recital of events in his active life.

One fare for the round trip to the Pan-American exposition at Buffalo via the Nickel Plate road beginning June 1 and continuing the entire summer; good returning within ten days from date of sale. Write, wire, 'phone or call on nearest agent, or E. A. Akers, C. P. & T. A., Cleveland, Ohio. 84, Aug. 1.

NOT HALF AS MUCH AS LAST YEAR.

MOVEMENT OF FREIGHT OF ALL KINDS TO AND FROM LAKE SUPERIOR—FULL REPORTS FROM THE CANAL OFFICIALS.

Reports from the canals at Sault Ste. Marie show that the movement of freight of all kinds to and from Lake Superior is not quite half what it was on June 1 a year ago. The figures are 2,248,045 net tons on June 1, 1901, against 4,565,879 tons on June 1, 1900, and 2,908,068 tons on June 1, 1899. Causes of this shortage are, of course, well understood—the engineers' strike and a late opening of navigation. The decrease applies to all lines of freight but is, as might be expected, especially marked in the big items of iron ore, coal, grain and lumber. The iron ore shipments (net tons in the canal reports) foot up only 1,172,532 tons thus far this year, against 2,733,525 tons a year ago; bituminous coal, 360,086 tons, against 724,958 tons; anthracite coal, 107,168 tons, against 155,082 tons; wheat, 5,959,542 bushels, against 14,216,221 bushels; flour, 921,573 barrels, against 1,194,183 barrels. The movement of all kinds of freight for three years past is fully set forth in the following tables:

MOVEMENT OF PRINCIPAL ITEMS OF FREIGHT TO AND FROM LAKE SUPERIOR.

ITEMS.	To June 1, 1901.	To June 1, 1900.	To June 1, 1899.
Coal, anthracite, net tons	107,168	155,082	128,789
Coal, bituminous, net tons	360,086	724,958	317,201
Iron ore, net tons	1,172,532	2,733,525	1,619,394
Wheat, bushels	5,959,542	14,216,221	8,443,388
Flour, barrels	921,573	1,194,183	773,238

REPORT OF FREIGHT AND PASSENGER TRAFFIC TO AND FROM LAKE SUPERIOR, FROM OPENING OF NAVIGATION TO JUNE 1 OF EACH YEAR FOR THREE YEARS PAST.

EAST BOUND.

ITEMS.	Designation.	To June 1, 1901.	To June 1, 1900.	To June 1, 1899.
Copper	Net tons	8,996	19,423	10,833
Grain, other than wheat	Bushels	2,811,928	2,383,301	8,335,892
Building stone	Net tons	4,280	2,396	923
Flour	Barrels	921,393	1,194,073	773,238
Iron ore	Net tons	1,172,532	2,733,525	1,619,394
Iron, pig	Net tons	2,689	2,744	2,347
Lumber	M. ft. b. m.	87,792	120,832	97,266
Silver ore	Net tons	.....	.....	.....
Wheat	Bushels	5,959,542	14,216,221	8,443,388
Unclassified freight	Net tons	4,098	8,364	28,347
Passengers	Number	2,949	1,723	867

WEST BOUND.

Coal, anthracite	Net tons	107,168	155,082	128,789
Coal, bituminous	Net tons	360,086	724,958	317,201
Flour	Barrels	180	110	.....
Grain	Bushels	23,530	.....	4,000
Manufactured iron	Net tons	7,942	24,838	17,043
Salt	Barrels	99,346	67,217	75,465
Unclassified freight	Net tons	63,347	77,603	67,838
Passengers	Number	3,842	1,730	1,443

SUMMARY OF TOTAL FREIGHT MOVEMENT IN TONS.

	To June 1, 1901.	To June 1, 1900.	To June 1, 1899.
East bound freight of all kinds, net tons	1,694,181	3,573,228	2,365,806
West bound freight of all kinds, net tons	553,864	992,651	542,262
	2,248,045	4,565,879	2,908,068

Total number of vessel passages to June 1, 1901, was 2,103 and the registered tonnage 2,080,517.

It is in order, now that the Tashmoo-City of Erie race has shown all that may be expected of the fastest side-wheel passenger steamers of the great lakes, to hope that the advertising agent's stories of speeds ranging anywhere from 25 to 30 miles an hour will be set at rest—at least until some new flyers are built. The actual maximum speed of a trifle more than 22 miles an hour, or possibly not quite 22 miles if the distance run by the vessels was a little over-stated, fixes the speed of these ships for all time, as a race was never run under more favorable conditions and the power and endurance of machinery in both vessels was developed to the limit.

The all important statement to lake vessel interests of iron ore shipments to June 1, compared with the shipments on June 1 a year ago, is not as yet at hand, but it is still probable that the total will fall short of 1,500,000 tons, as against about 3,500,000 tons on June 1, 1900. Unofficial returns from three ports at the head of Lake Superior—Duluth, Two Harbors and Superior—show a total of 788,549 tons, compared with 1,790,999 tons last year.

CURVE OF STABILITY.

BRIEF METHOD OF DETERMINING IT—PRACTICE OF SCOTCH SHIP BUILDERS IN THIS IMPORTANT PROBLEM OF SHIP DESIGN.

By George Crouse Cook, A. M. I. N. A.

The importance and value of investigating the stability of a proposed ship design, and so modifying the work as to give such stability as has been proved satisfactory in actual practice, has been generally acknowledged by modern designers. But in many instances, and especially in the smaller offices not equipped with the mechanical integrator, calculations beyond the initial stability or metacentric height are wholly overlooked, and the actual stability at large angles of inclination is assumed to be that of some similar ship. This is obviously unreliable and often leads to the production of a vessel of such stability as to be not only a source of annoyance to the crew and officers, but also a constant danger. Defective stability may possibly be corrected by the introduction of some form of ballast, but this involves the expense of transporting an unnecessary dead weight and the corresponding reduction in carrying capacity, which lessens the earning power of the ship.

This subject is fully understood by the economical, practical Scotch ship builders along the Clyde, and the following comparatively short, convenient method of plotting the stability curve (a curve of righting arms for a constant displacement and varying angles of inclination) of a design is in use among them for such general merchant work as does not require elaborate and exhaustive calculations. Its chief value lies in its convenience for estimating the stability of a preliminary design, which is to be again worked over accurately; but when the design is for a ship similar to some form for which the corresponding curve is known, and with which the general character of the new curve may be judiciously checked and compared, it may be taken as giving the true stability curve.

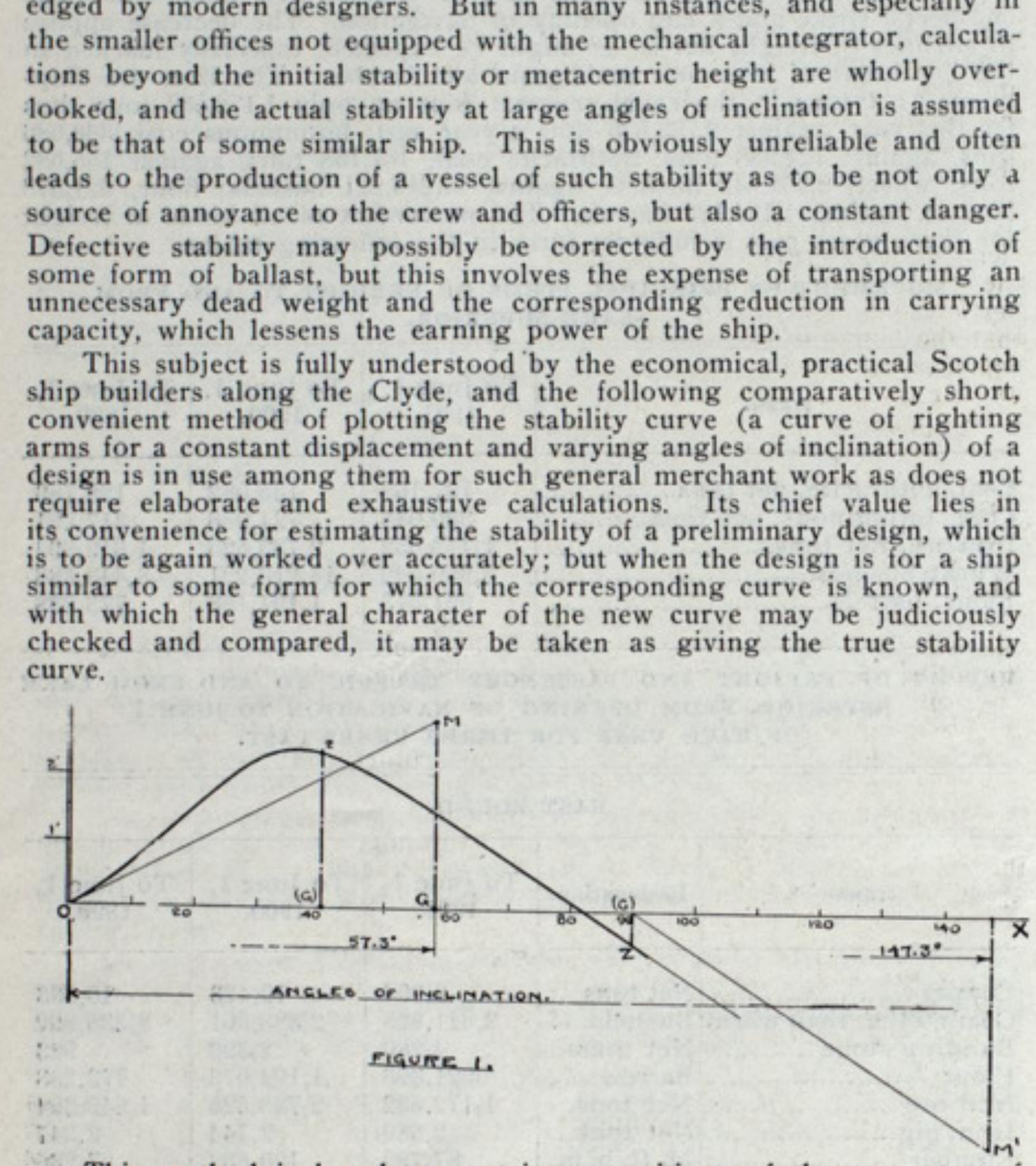


FIGURE 1.

This method is based on certain propositions of the geometry of stability and is composed of the results of investigations of three conditions of the ship: First, when the ship is upright; second, when heeled to an angle of 90°; third, when at some convenient intermediate condition, as the angle corresponding to the point of submersion of the deck edge, or about 40° to 50°. These investigations are so performed as to involve the calculations for displacement, center of buoyancy and the metacenter only, and therefore the method may be used with fair confidence by anyone familiar with the conventional displacement sheet, while in the hands of an experienced calculator it can be brought to give absolute results.

FIRST CONDITION, THE SHIP UPRIGHT.

Assume the displacement sheet to be completed and from it take the metacentric height, G M, which is applied in the following manner as a component of the stability curve: On a line O X, Fig. 1, set off from O to some suitable scale, as ¼-in.=1°, the degrees of inclination of

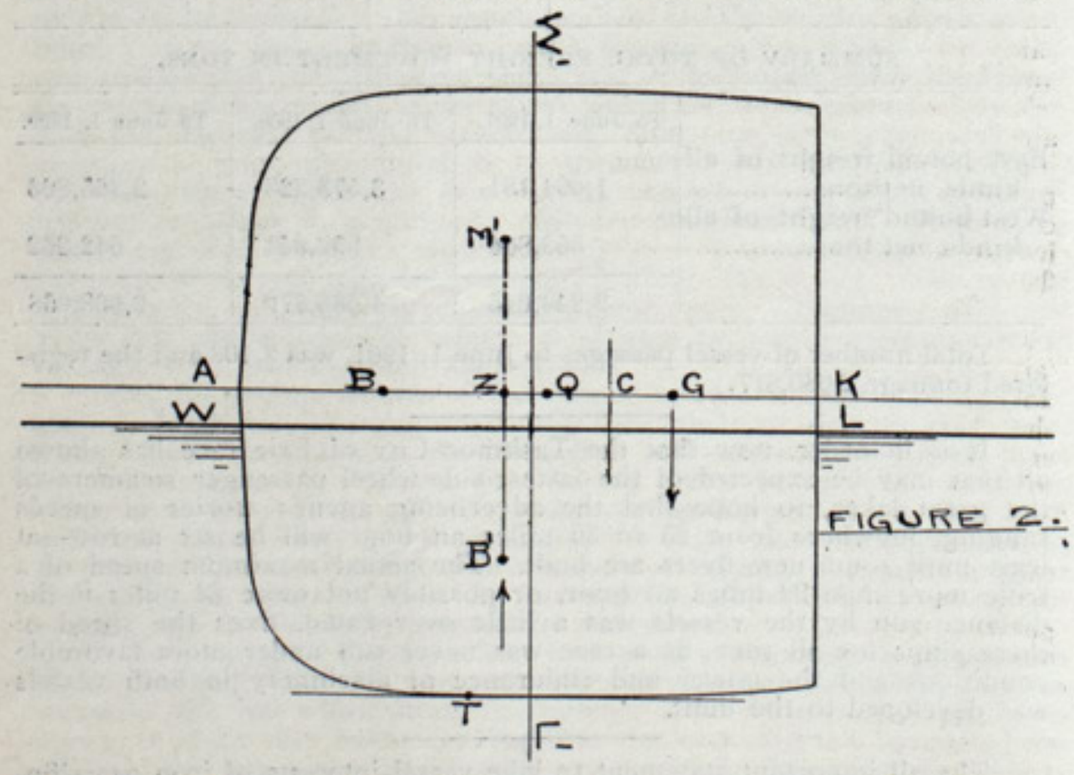


FIGURE 2.

the ship from the upright position which is represented by O. Then at the point G, corresponding to 57.3° on O X, erect a perpendicular, and on this set up the metacentric height, G M, to the scale chosen to represent the righting arms, say 3-in.=1 ft. Connect O and M by a straight line O M; this will then determine the initial direction of the curve, as it is a tangent to the curve of stability at O.

SECOND CONDITION, THE SHIP HEEL TO AN ANGLE OF 90°

In Fig. 2 let W L be the horizontal water line, W' L' the water line when upright and A K the original vertical center line. Let V represent the volume of the constant displacement W' A L', or W T L' L, and H be the volume of the total water excluding body. H is found by extending the operations of the displacement sheet for the upright condition to include the whole body, and Q, the center of this volume above the keel, is found in this work by the same method as B, the center of buoyancy of the upright displacement W' A L'. Now a series of water lines are laid off from the lowest horizontal tangent at T, the displacements calculated, and a displacement curve drawn to include the region about W L; on this curve the value of B is plotted and the corresponding ordinate gives the height of W L above the tangent, which determines the thickness of the volume A W L K. The height of B', the center of buoyancy of W T L' L, must be determined, and then the horizontal position of the center of volume of the layer A W L K is found by independent calculation to be, say, in the vertical through C. Now if Z, the point of intersection of a vertical through B' and the original vertical center line, which is now a horizontal through G, be determined, the righting arm at 90° may be measured. If V and H/2 were equal, W L would coincide with A K, and B' would be in the vertical through Q; but V is here less than H/2 by the volume of the layer A W L K, which is equal to (H/2—V), therefore B' is out from the vertical through Q, a distance which is dependent on the volume and position of the center of the layer. Therefore by moments:

Q Z×V=Q C (H/2—V).

Q Z=Q C (H/2 V—I).

Then, Q Z+Q G=G Z. (The negative righting arm at 90°).

Plotting Z gives the horizontal position of B' as it is in the same vertical; this then completely determines the position of the center. Now the inertia of the non-symmetrical water plane, W L, about a fore-and-aft line through Z, is calculated, and by substitution in the formula for the height of M above B (B M=I/V) the specific value of B' M' is found. On plotting this value of B' M' in Fig. 2 it is seen that Z M' represents the vertical distance between G and M', the metacentric height. This righting arm and metacentric height are now used as additional components of the desired curve.

At the point on O X, Fig. 1, corresponding to 90°, G Z is set off below the line, as it is the arm of an upsetting couple; then at 57.3° on from 90° or at 147.3° the value of Z M' is set down on a perpendicular from O X; connect M' and 90°; then, as in the first condition, the direction or slope of the curve at 90° is determined by this line. But the curve is known to pass through the point Z, and therefore if a line is drawn through Z parallel to 90-M', the curve must be tangent to it at this point Z.

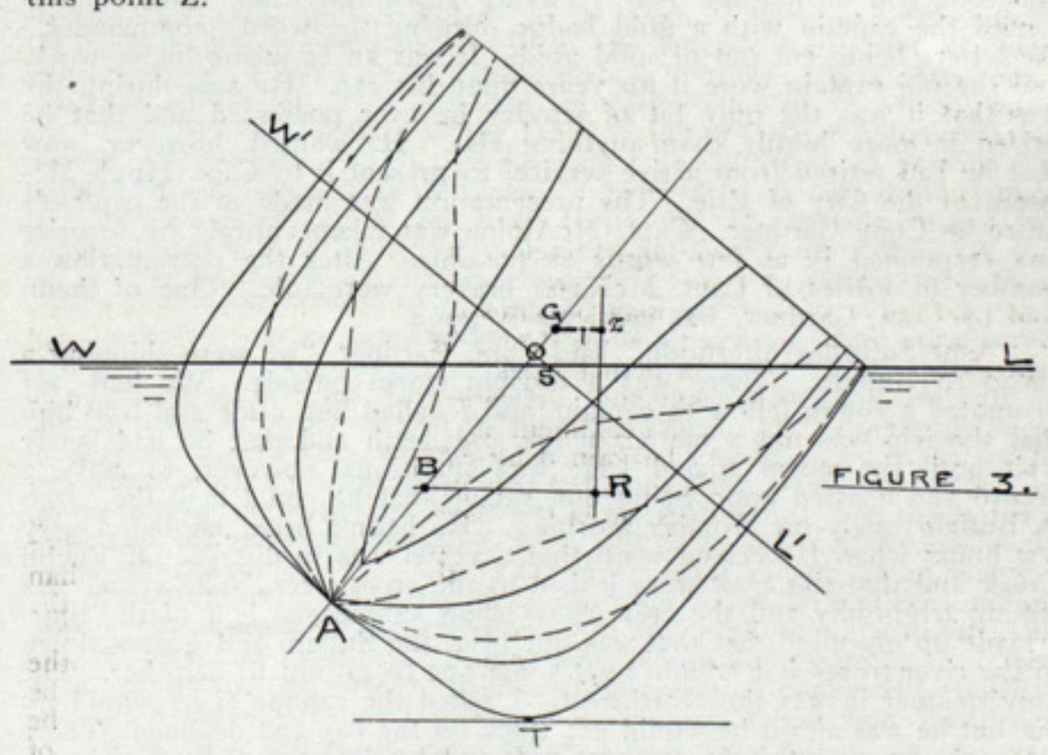


FIGURE 3.

THIRD CONDITION, THE SHIP INCLINED TO THE "DECK EDGE" ANGLE.

The righting arm for this condition could be found by the well-known Barne's method of polar integration, but the following substitution, while involving the same principles, may be used with but a little loss in accuracy and a great saving in time. This loss, however, is not of great importance, as those leading features of the curve, the initial slope and the range, are so well defined by the conditions of the tangents.

On a complete body plan, as Fig. 3, a water line, W L, is drawn through the lowest point of the deck edge so that it cuts off, as estimated by the eye, a displacement equal to that of the upright. This can be done with fair accuracy by carefully comparing the portion of each section which is cut off, as W S W', with that part added, L W L'; the means of these as functions of the volume must be equal, as the displacement taken from the left hand side must be added on the right so that the total volume remains the same. For the usual ship-shape form, where the deck edge is not submerged at an inclination of about 40°, W L will fall below the point O, a distance, measured on the vertical, varying from 6 in. to 12 in.

Now the horizontal position of the center of buoyancy for the form of displacement W A L must be found. This is most simply done by the principle of moments, where the volume of the transferred displacement L S L' or W' S W into the distance its center of gravity has moved constitutes the moment, and this moment divided by the total volume of the displacement gives the distance the center of buoyancy has shifted. For the purpose of finding the moment of this volume of wedge-shaped displacement the shifted portion of each section, as L' S L, is assumed to be a triangle; this is quite justifiable in many cases, and where the line of the section is much curved within the limits of the

water lines an equivalent triangle may be constructed which will have the same area and center of gravity.

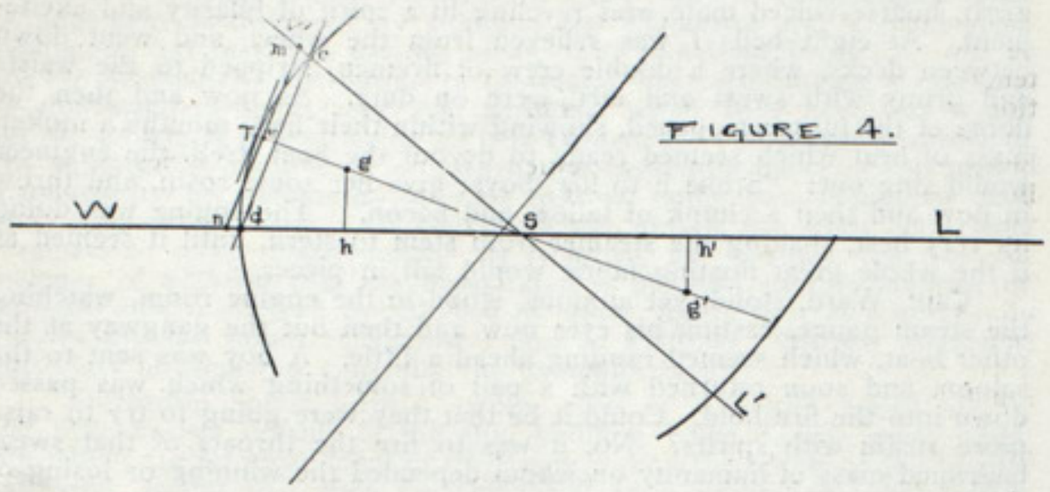


FIGURE 4.

Let Fig. 4 represent a portion of some curved section. To construct an approximately equivalent triangle which will represent this section, c and d are connected and a tangent drawn to the curve parallel to c d. At two-thirds of the distance from c d to the tangent the parallel line m n is drawn, which completes the required triangle S m n. Bisect m n at e, then g, the center of gravity of the triangle, is on the line connecting S and e, two-thirds of the length from S. A similar construction will give g', the center of gravity of the area in its new position. Then from the vertical projection of g and g' upon W L, the lever, h h', for the horizontal moment is taken, and this lever into the area of S m n is the moment of the area transferred by the heeling. This moment is an element of the integration to be made by the Simpson's rule for the moment of the transferred volume. The work can conveniently be arranged in the following tabular form:

SECTION	AREA	LEVER	PRODUCT	MULT.	FUNCTION
1	a_1	hh_1	$a_1.hh_1$	1	$a_1.hh_1$
2	a_2	hh_2	$a_2.hh_2$	4	$4.a_2.hh_2$
3	a_3	hh_3	$a_3.hh_3$	2	$2.a_3.hh_3$
Etc.					Etc.
					Σ a.hh

Σa.hh$\times$⅓ longitudinal interval=moment of volume.

Then dividing this moment by the volume of the total displacement gives the horizontal distance the center of buoyancy has moved. This new horizontal position of B is then plotted in Fig. 3 at R, a vertical line is drawn through R and the righting arm for this angle, G z, is the horizontal distance from G to this vertical through R.

Turning again to Fig. 1: The arm G z is set up from O X at the point representing the "deck edge" angle of inclination, say 40°. Now the slope of the curve at the initial point, the arm and slope at 90° and the arm at 40°, are known, and therefore with a light true batten placed tangent to O M at O, passing through z, and tangent to the line of slope at Z, the curve of stability may be drawn. Experience has shown that for a normal form a curve thus found may be taken as fairly accurate and dependence placed on it in actual work.

Modifications in the text and application of the method quickly suggest themselves. The most prominent is perhaps that in the last condition where accuracy can be gained by calculating the true position of the water line, which will lead to the true position of R, by the difference of the volumes of the wedges, as in the Barnes' method, or by setting up a displacement curve from T, Fig. 3, as in the second condition. Another step leading to greater accuracy would be the introduction of more than one intermediate point, say two, one at 30° and also at 60°. Then in the opposite direction a slight loss in accuracy may be conceded with a considerable saving in labor. In the second condition, for instance, the position of the water line may be determined by the eye and should it be near the center line plane, the center of gravity of the plane may be taken as that of the layer A W L K, and also its inertia used as that of the water line in the calculation for B' M'. Then too, some approximate method, as that given in White's "Naval Architecture," may be used for estimating the initial B M. These approximate methods have, of course, their chief value in the facility with which a result can be obtained that will give a fair and reliable check on the qualities of a preliminary design, so that the trouble and expense of altering more complete and detailed plans may be avoided.

It is the earnest desire of the writer to eliminate all error and misunderstanding from this article and to extend his knowledge of the matter under discussion, and he will therefore be pleased to receive and will endeavor to answer criticisms and questions concerning the matter. Address in care of the Marine Review Pub. Co., Cleveland.

KRUPP ARMOR PLATE THAT FAILED.

An examination of the Krupp armor plate, representing 300 tons of armor for the battleship Maine, which failed to fulfill the requirements in the official test at the Indian Head proving grounds last week, shows that cracks in the plate existed prior to the test. The specifications permit another test; and if this is successful the government will have the option of testing a third plate to determine whether the group of armor represented comes up to the requirements. Should the second test prove unsuccessful the entire group of armor would be rejected. The official report has not been received at the navy department and decision as to whether there will be a second test will be reserved until it has been received by the naval ordnance officials.

Thomas McCosker & Co., Baltimore, Md., launched last week a wooden tug boat 112 ft. in length, 25½ ft. beam and 10½ ft. deep, for the National Dredging Co. She will be put in service in Mobile, Ala.

THE QUESTION OF COPPER SHEATHING.

The following article in the Naval Military Record, questioning the propriety of sheathing the British Royal yacht, will be read with interest in the United States where sheathing is an unsettled question:

"To sheath a ship with copper for its anti-fouling properties alone is not only not worth the initial outlay, but really results in a great waste of money for the extra coal burnt, and also a great loss in efficiency. On stations where there are docks, it is the custom for sheathed ships to be docked once a year. At the end of the year, however, the bottom of such a ship will be found to be in a worse state than the bottom of an unsheathed ship which is docked every six months, in spite of the anti-fouling properties of copper. Where there is only a little weed on the latter ship, the former will be found covered with minute shells of animal organisms and embryo barnacles. Consult the log of the sheathed ship and the engine room register, and compare the vessel's speed at the beginning and the end of the year, and the result is startling. Again compare these results with the performances of a sister vessel which (being unsheathed) is docked every six months, and the result is still more startling.

"The anti-fouling qualities of copper presuppose that it is originally clean and smooth on leaving dock. This may be true on first leaving the dock yard, but unfortunately it is not always the case during the periodical dockings of a ship's commission. We have reason to believe that the admiralty are beginning to doubt, or are not satisfied with, the superior anti-fouling qualities of copper, because at the present time, and for the past two or three years, they have been experimenting with a composition for coating copper-bottomed ships. Why should it be necessary to go to the expense of coating sheathed ships with anti-fouling composition if copper is really so effective as it is believed? As a matter of fact, we are of opinion that the necessity for coating sheathed ships does not arise from a mistaken idea of the merits of copper, but the reason may probably be traced to the cleaning of ship's bottoms when in commission. The usual plan is to scrub down as the water is pumped out of the dock, and this is probably good enough for a six months' docking of unsheathed ships, when there is little more than weed upon the ship. The scrubbing is done by the ship's crew, and when, later on, the dockyard painters come along to put the composition on, they remove any roughness that may be left before applying it. With a sheathed ship, however, that is not to be painted, the scrubbing as the water is pumped out, as a general rule, has to be sufficient. As there is no composition to be applied, the immediate necessity for making the ship's bottom absolutely smooth is probably not taken into account, and the consequence is that a rough surface is formed by myriads of minute shells, which remain as a nucleus for future growth. Cleaning a ship's bottom ought not to be treated as an evolution to be performed as quickly as possible, but the chances are that the work being altogether outside the commanding officer's usual routine, the time for cleaning the ship's bottom is cut down to the shortest possible limits. This is shown by the following illustration:

"Two or three years ago, two sister ships, both sheathed, were docked at the same time side by side. Both had the usual scrub down as the water was being pumped out of the dock, the operation being apparently completed at the same time. The dock yard officials, however, thought that one of the ships on docking had a much larger growth than she ought to have had since the previous docking. The consequence was that they applied for and received permission to try the effect of a special coating of anti-fouling composition for copper-bottomed ships. In order to watch the effect properly, only one side of the ship was to be coated; the other side was to be left bare. When the painters arrived to apply the composition, they found that it was absolutely useless to attempt to apply the paint to the so-called clean bottom, and a squad of men were specially applied for days in scraping off the minute shells that still adhered after the ship had been scrubbed down. This having been done, and the paint applied, the other side of the ship had also to be scraped and cleaned with similar care, in order to make a fair comparison. Whether the coated side or bare copper side proved the superior history does not relate, but the same green composition is still being applied to sheathed ships, and it may be presumed that it is still under trial, or its superiority over bare copper has been proved. Shortly after the two ships in question were completed both were sent on a voyage, practically in company, going the same distance, in the same time, and experiencing the same weather. The speed was 11 knots, and both ships started with four boilers alight; but, whereas the ship which had been properly cleaned maintained its speed with perfect ease and comfort in the stokehold, the other ship, after struggling hard to maintain the same speed, eventually had to light another boiler. Comparisons at the end of the trip showed that one ship had averaged eight or nine revolutions more than the other for the same speed, and with an increased coal consumption of 10 to 12 tons a day. Comment is superfluous.

"This illustration may not form a conclusive argument against the sheathing of ships, but it must be remembered that this was a case of a fair comparison between two ships which were supposed to leave the dock both in the same clean condition. It is not the theoretical value of sheathing that has to be considered, but the result of working under general service conditions. No unsheathed ship would have been allowed to leave dock in the rough state of one of the ships mentioned above, and it must be remembered that the other would have left in a similar state but for the fact of trying an experimental coating of paint. The case of these two ships is probably not an isolated one, and, if sought for, many more examples could be found where the sheathing of ships has, perhaps indirectly, been the means of keeping the bottoms in a continually foul condition."

Preparations have been made for the launching today (Thursday) of the steamer Mary C. Elphicke at the Chicago works of the American Ship Building Co. This is the second steel freighter launched this season at the Chicago works for Mr. C. W. Elphicke and others of Chicago. The other vessel, the Wm. L. Brown, was launched a few weeks ago. Dimensions are 450 ft. over all, 430 ft. keel, 50 ft. beam and 28½ ft. depth of hold. Engines are triple expansion with cylinders of 23, 38 and 64 in. diameter and 40 ft. stroke. Scotch boilers furnish steam at 180 lbs. pressure. The capacity of the ship is about 6,300 gross tons.

STEAMBOAT RACE OF FORTY YEARS AGO.

Now that the Erie-Tashmoo race is a thing of the past it might be well to recall another exciting race on the great lakes. Henry W. Inman of Detroit was a wheelman on one of the old Eber Ward steamers, the Ocean, at the time of its celebrated victory over the Empire State about forty years ago. He wrote the following account of the race for the Detroit News last week:

Among the larger boats built by the late Capt. Eber B. Ward at Marine City was the Ocean for the Detroit and Buffalo north shore line. It was on this boat I was initiated into the duties of a steamboat man. The Ocean was calculated to be not only of fine model and proportions, but to excel all others of her class on the lakes in speed. At this time the Empire State was the favorite steamboat of Buffalo. She was large and speedy and formed a line by herself between Cleveland and Buffalo, leaving Buffalo every alternate evening at about the hour one of the north shore boats left for Detroit. It is not surprising, therefore, that occasional tilts were indulged in, extending oftentimes up the shore as far as Long Point and beyond, resulting in no permanent decision as to which was the faster boat.

One bright moonlight night we were delayed by waiting for passengers at Buffalo until long after the usual hour for leaving. We had seen our magnificent rival of previous occasions pass by, as we supposed on her way out of the harbor, and therefore we little anticipated having a brush with her that night. But as we went down the creek we found the Empire State at the end of the pier, her lines singled up, a full head of steam on, and Capt. Hazzard on the pilot house, with the bell rope in his hand, ready to give orders. As we came along, "Let go!" rang out on the midnight air, and soon the great steamboats were struggling for supremacy that would give one or the other a prestige for speed, which in those days was the crowning glory of lake navigation. On this occasion, much to our chagrin and disappointment, the Ocean was badly beaten, for as the Empire State hauled off on her course toward Cleveland we were at least ten miles astern.

"We were too deep in the water," said the mate.

"Yes, and with three broken buckets on one of her paddle wheels," exclaimed the engineer.

"And her bottom needs scraping," remarked Capt. Willoughby, as he passed the little group who were endeavoring to smooth over their discomfort at being thus for the third time in as many weeks so badly left astern.

Capt. Ward, then the reigning prince of steamboat men, was on board and he said: "Gentlemen, we may not float as much wood and iron over the bosom of this lake as some other structures," casting his eyes toward the cloud of smoke left by our victorious rival, "but I built this boat for speed, combined with staunchness, beauty and comfort. I know her capabilities under proper conditions. I am also alive to the keen sense of disappointment and humiliation that creeps into the mind of the sailor when any laurels are plucked from the reputation of his craft under disadvantages beyond his control. In Buffalo I issued a challenge to Capt Hazzard for a fair and final contest with conditions that neither of us shall jeopardize the lives of the traveling public by allowing passengers on board, and that the broom, so tauntingly carried at his masthead as emblematic of superiority in point of speed shall remain or revert to the victor; that whichever boat is beaten her owner shall acknowledge defeat and refrain afterward from indulging in the little tilts that heretofore have resulted in no satisfactory decision in regard to the point at issue. And, now, Capt. Willoughy, whatever time, means or help are needed to put this boat in the best possible condition for a victorious termination of the coming race, they are at your disposal."

A person who has never witnessed a race between steamers nearly equal in speed can form only a meager conception of its excitement. It seems, as you stand on the deck, that the very turning of their ponderous wheels is actuated by a sense of what is required of them. The engine, doing its best, very best, struggles to increase its momentum and outdo itself. The furnaces laugh with an exultant roar as they open their fiery mouths and receive the inflammable fuel that is thrown into them. The crew, from the cabin boy and cook to engineer, mate and master, are carried away with excitement, hopes and doubts entirely different from anything manifested upon other occasions. For the danger is increased a hundredfold. An explosion from excess of steam is one of the possible results, or setting fire to the boat by the extraordinary heat necessary to raise the steam; in fact, a steamboat fitted for such a contest is but a little floating volcano, liable at any moment to belch forth steam, fire and destruction.

After we had arrived in Detroit and discharged our freight and passengers, the steamer was placed in dry dock, her bottom was scraped and greased from stem to stern, the broken buckets were replaced by new ones, the engine and boilers were overhauled and refitted, and then, after taking on several barrels of rosin and many great sides of greasy bacon, we cast off and made an unusually swift run to Cleveland, the starting point.

"We must not be beaten," said Capt. Ward, who was on board. "We are the challengers and it would not be pleasant to return without the broom the Ocean so long has been entitled to carry. Besides, I have $10,000 at stake, and I would wager boat against boat that the Ocean is the fastest steamboat on Lake Erie."

Capt. Hazzard, master and owner of the Empire State, had been informed of our proceedings, and had put her in the best possible trim for the race. As we approached Cleveland harbor, the Empire State came steaming out majestically, and courteously awaited until we could round to for a fair and even start. The piers and docks were crowded with people, who had come from every part of the city to witness the starting of the two magnificent racers, and as the sun went down over the western hills their engines were put in motion. Great clouds of smoke came pouring out of their funnels, and fountains of crystal spray began shooting out from their bows as the speed increased. The Ocean was about a length astern at the start, but gradually drew upon her antagonist, and by the time we were abreast of Fairport, 30 miles distant, it would have been difficult for the keenest eye to detect any advantage by either boat.

The night was splendid. Scarcely a ripple disturbed the almost mirror-like bosom of the lake. The moon, round and full, was making silvery pathways over the broad expanse of water, while soft, fleecy clouds were floating overhead. It was a magnificent passage down the lake, and every one on board, from the little ebony-colored porter to the great, hoarse-voiced mate, was reveling in a spirit of hilarity and excitement. At eight bells I was relieved from the wheel, and went down between decks, where a double crew of firemen, stripped to the waists and grimy with sweat and dirt, were on duty. As now and then the doors of the furnaces opened, showing within their fiery mouths a molten mass of heat which seemed ready to devour the boat itself, the engineer would sing out: "Stoke it to her, boys; give her some rosin, and throw in now and then a chunk of tallow and bacon." The engine was doing its very best, shaking the steamer from stem to stern, until it seemed as if the whole great floating fabric would fall in pieces.

Capt. Ward, stolid, yet anxious, stood in the engine room, watching the steam gauge, casting his eyes now and then out the gangway at the other boat, which seemed ranging ahead a little. A boy was sent to the saloon, and soon returned with a pail of something which was passed down into the fire hold. Could it be that they were going to try to raise more steam with spirits? No, it was to fire the throats of that sweat begrimed mass of humanity on whom depended the winning or losing of this race.

We had put 100 miles or more behind us, when for some reason the Empire State began slowly to drop astern. Had she given up the contest, or had some part of her machinery become disabled? Suddenly the broom was hauled down from her masthead, and then the Ocean became a floating pandemonium. The shore echoed back the shouts and wild huzzas that came from the excited crew. On the hurricane deck of the Ocean there was another scene. The extraordinary heat from all those inflammable articles of fuel had painted the smokestacks a lurid red some 3 ft. above the crown of the deck, and all around stood clerks, cooks, waiters and even our most fastidious chambermaid, with buckets of water, ready to quench the first flames on the already crackling woodwork. Was there anything particularly at stake, on all this endangering of human lives? Oh, no, only the value of a few dollars and the prestige gained or lost in the steamboat world.

The Ocean gained rapidly, and when we had placed the Empire State at a safe distance astern, our speed was slackened. The red heat that had crawled up the smokestack slowly receded, and the crew, unmindful of position or station, mingled in a revelry seldom seen on land or water.

INITIAL PAYMENT ON THE TURKISH CRUISER MADE.

The Turkish government has made its initial payment upon the cruiser which the Cramps of Philadelphia undertook to build for it and work will now proceed upon the warship. The new cruiser will have a length of 240 ft. on the load water line, with a beam of 42 ft., a depth of 30 ft. and with 16 ft. draught of water. This will give her a displacement of 3,250 tons. She will be equipped with triple expansion engines and Niclausse water-tube boilers and will be expected to make a speed of 22 knots.

In armament the vessel will have unusually heavy batteries for cruisers of her class and size. The main battery consists of two 6-in. quick fire guns to be placed one forward and one aft on the middle line of the ship, and protected by armored shields; eight 4 7-10-in. quick fire guns placed as a midship battery and also protected by armored shields. The secondary battery consists of six 47-millimeter rapid-fire guns and six 1-pounder rapid-fire machine guns, and these are also to be protected by armored shields. In addition, there are to be 175 magazine rifles for the crew. The hull will be protected by the customary protective deck, as will be the machinery.

The entire ship will be lighted by electricity, and there will be four searchlights, two forward and two aft, located on the superstructure and on the military tops. All the ammunition hoists are to be operated by electricity and by separate motors. The cruiser is to have two steel masts with military tops, with wooden spars for signaling. In internal fittings the details of construction used in the United States navy will be closely followed. This applies to ventilation, sanitation, and includes space for quarters for officers and crew. The contract calls for the same interpretation of contract clauses as is given to similar clauses for the navy department of the United States.

Owners of the Whitney fleet of vessels of Detroit have for years done business with the ore firm of Oglebay, Norton & Co., Cleveland. That firm, through the amalgamation of great ore interests in the United States Steel Corporation, has little business now to offer to vessel owners, compared with what they have had in the past. It is not probable that this will always be the case, as Oglebay, Norton & Co. have not by any means gone out of business altogether, but it is quite true that the present condition had much to do with the sale of the Whitney vessels to J. C. Gilchrist of Cleveland. The fleet is a good one and a substantial addition to the very large amount of vessel property already controlled by Mr. Gilchrist, whose purchases of late have been on a scale that would, if kept up, soon place him almost on a level with the Steel Corporation. Included in this latest purchase are the steel steamers D. M. Whitney, E. W. Oglebay and Merida and the wooden steamer Mecosta.

The Joseph Dixon Crucible Co., Jersey City, N. J., has issued a book devoted to graphite and its uses. It is beautifully printed and exquisitely illustrated with wash drawings. Every phase of the company's work is gone into in the most entertaining manner. The narrative begins in 1827 when Joseph Dixon began to revolutionize the crucible business; it continues up to 1901, every year contributing to the evolution of the business. The company will be pleased to send the book to anyone who is interested in its products.

Following is an extract of items from the annual report of the Wm. Cramp & Sons Ship Building Co. for the year ended April 30, 1901: Gross earnings, $7,319,000, against $7,791,560 last year; profit over cost of material, labor, etc., $743,000, against $913,000 in 1900; net earnings, after general expenses, interest, etc., $291,772, against $536,262 last year; dividends, $242,000, unchanged; surplus, $49,762, against $294,292 last year.

STEAMSHIP BONDS.

A few years ago steamship bonds were unknown on the great lakes. Vessels were built almost entirely for cash. But a conservative bond arrangement inaugurated by some of the Cleveland and Detroit trust companies has met with decided favor. The Guardian Trust Co., one of the strong financial institutions of Cleveland, has been making a specialty of this business and a very neat pamphlet which they have just issued on the subject is as interesting as it is attractive. The striking feature of the pamphlet is a summary of information regarding many of the vessels accompanied by statements showing the low bond issue compared with the value of the ships. Of course all the vessels are high class steel steamers of recent construction. It is noted, for instance, that on one steamer of $225,000 cost the bond issue is $72,000; another steamer of $275,000 cost is covered by $275,000 of bonds, and a fleet of four vessels carries $330,000 bonds as against a cost of $580,000. On the subject of this class of securities generally the pamphlet says:

"Steamship bonds form a strong class of securities which are as yet little known outside of the ship building cities on the great lakes, but which are no more local in their nature than the bonds of the largest railroads, seeing that they are incidental to a great commerce which traverses or touches more states than do 75 per cent. of the railroads whose securities are listed on the New York stock exchange, and whose tonnage during a season of but eight months is far in excess of that of the New York Central, Baltimore & Ohio and many other railroads combined for an entire year. These have thus far been almost entirely absorbed in the cities of Cleveland, Chicago and Detroit, having been purchased in large amounts by individuals, banks and trust companies in those cities who were familiar with the lake shipping industry and with the companies engaged in it. The issuing of bonds upon lake vessels in the same manner as upon railroads being a practice of comparatively recent origin, it was the natural course of events that securities of this class should for some years find their market only among those who had first-hand knowledge of their value as investments, until time should demonstrate it to outside investors. No holder of steamship bonds to our knowledge has ever suffered the slightest delay in the payment of his interest or principal. Adding to these features—of strength and a record for punctual payment—their present favorable prices, the bonds prove to be desirable in every way for the investment of private, trust and bank funds. The constantly widening acquaintance among investors with the value of these securities has been and is appreciating their price steadily. Selling formerly at a discount, they are now quoted at a small advance above par, and their intrinsic merits warrant the opinion that they will in a few years command a substantial premium.

"The customary plan of issuing these bonds is substantially this: The bonds are delivered to the purchasers upon completion of the mortgaged vessel, and cover usually one-half of its cost—sometimes less, seldom more. They mature in most cases in ten or twelve equal annual installments, beginning the year of their date or the year after. The holders of the longest bonds have constant security, for the debt is steadily diminished, and, besides, the life of modern steel steamers is from fifty to sixty years, and the insurance underwriters give them their initial rating for twenty-five years, so it is evident that no depreciation of consequence occurs during the life of bonds issued for less than one-half of that time. Of course, an annual overhauling of the vessels and their machinery is necessary, which is paid for out of net earnings. By requirement of the mortgage the boat is kept insured 'in good and responsible insurance companies selected or approved by the trustee,' in a sum at least equal to, and usually to a fixed amount in excess of, the outstanding bonded indebtedness, losses being payable to the trustee, who also always keeps possession of the policies. Priority of lien, and bondholders' interests in case of default, etc., are carefully safeguarded, by provisions as binding and efficacious as the similar clauses of any railroad or other mortgage. The vessels are operated by well-known companies, owned and managed by men who are among the oldest and most successful vessel owners on the lakes."

PLANNING TO SELL TO THE BIG STEEL COMPANY.

A Philadelphia dispatch says that the activity in the steel stocks there indicates that the syndicate of underwriters, headed by Drexel & Co., who have organized the Pennsylvania, Cambria and Bethlehem steel companies, have undertaken a plan to consolidate the ownership of those three companies, with the object of transferring them as a single organization to the United States Steel Corporation. Following the announcement by Drexel & Co. on Monday that $20,000,000 of the new issue of capital of the Pennsylvania Steel Co. had been sold by the underwriting brokers to investors, there was a rapid buying movement in stock of the Cambria Steel Co., led by a house representing John Lowber Welsh, one of the underwriting capitalists and also a director of the company. Tuesday the directors of the Cambria Steel Co. met and adopted a plan of readjustment similar to the one applied to the Pennsylvania Steel Co. in January, increasing the capital from $16,000,000 to $50,000,000. The last assessment on the stock of $3 was paid on Saturday, making the shares stand 13½. To meet the requirements of the plan the directors declared a dividend of $1.50 on the common stock. The Cambria plan will be backed by the Drexel syndicate. It was ascertained from well-informed sources that this syndicate will finance a plan of consolidating the three steel companies to facilitate the sale to the Steel Corporation. An announcement of the undertaking is expected in a few days. The capitalization of the three companies, including the bonded debt and old stock not cancelled, is in excess of $150,000,000, but the paid-up value of the stock is less than half that amount.

FOURTEEN FEET NAVIGATION IN THE ST. LAWRENCE.

Some time ago Mr. Thomas Monro, well known engineer of canals in Canada, was quoted in these columns as saying that a 14-ft. channel existed between the great lakes and Montreal through the St. Lawrence, notwithstanding all views to the contrary which appeared in the Canadian newspapers. It would seem that this statement is fully confirmed by the following extract from the Montreal Herald of May 27:

"The certainty of the 14-ft. navigation in the St. Lawrence channel and canals between the great lakes and Montreal has been placed beyond doubt by the achievement of the Ottawa Forwarding Co.'s propeller Arabian. The big boat, which has been in the transportation business for some years has just arrived down with a cargo which bore the hull down to 14 ft. 2 in. This is the deepest draught under which a vessel has ever been brought down, and the owners and master are consequently jubilant. It has been proved that a capable master, by using ordinary prudence, can navigate the new 14-ft. channel without the slightest danger. An answer has also been given to the pessimistic critics who have been maintaining that the channel was not navigable by any vessel drawing 14 ft. At the point where the Northwestern, bound for Europe, touched ground the Arabian passed freely, thus corroborating the explanation made at the time as to the cause of the mishap to the pioneer of the Chicago-Liverpool line. The dredge is still working at the point where that vessel went aground, but the Arabian passed well away from it in the center of the channel."

FLOATING DOCKS.

Worth more probably than anything ever published on the subject of floating docks is a pamphlet of some fifty pages, well printed and well illustrated, which comes from Clark & Standfield of London and which is entitled "Facts about Floating Docks." Clark & Standfield are probably the only firm of engineers in the world making a specialty of floating docks. They are the engineers in charge of the construction of the 18,000-ton floating dock which is being built for the United States government at Sparrow's Point, Md., and which is to be located at Algiers, near New Orleans. Docks now in course of construction under their supervision have a lifting power of 67,000 tons. Most of the information contained in the pamphlet was first brought out in this country when the subject of docks for our naval vessels attracted so much attention in congress a short time ago. The introduction to the pamphlet, which is in itself very interesting, is as follows:

"In 1898, the action of the navy department of the United States in sending the battleship Indiana to Halifax to be dry docked, on account of there being no graving docks in the states that could take this vessel, rudely opened the eyes of the American public to the dearth of docking accommodation for their then rapidly growing fleet, and a comprehensive scheme of docks was promptly laid before congress. Inventors, naturally, took this opportunity to extol their own wares, one of them, indeed, issuing a pamphlet in praise of his special type of excavated dock, in the course of which he made a very direct attack on floating docks in general. To those acquainted with floating docks many of the statements made on the subject were absurd, but as anything printed, unless promptly contradicted, attains a glamour of truth, it seemed to naturally fall upon us, the only firm in the world which makes the designing of floating docks a specialty, to reply for and defend the same. Hence the reason for the publication in the United States of a large part of what is contained in the pamphlet, which was of a distinctly controversial character and was meant to advertise and defend the floating dock from the attacks made against it. The controversial portion of the pamphlet is now no longer required, for time has settled this question—and we may be pardoned if we add in our favor—but the facts and comparisons appertaining to the two types of docks, which were also contained in the same pamphlet, still have their value, for it is a regrettable fact that there is a universal ignorance not only as to what floating docks can do, but as to what they have done, and, indeed, even as to the number and size of them that actually exist.

"During the present year (1901) a member of a certain harbor board is reported to have stated that 'there are something like 1,800 dry docks, floating docks, and slipways in different parts of the world, and out of this total there are only about 100 floating docks, and, as a rule, they are of small dimensions. In the United Kingdom, the largest of these floating docks is only 144 ft. in length.' If this gentleman had consulted the admiralty dock book published yearly, he would have found out that there were really 168 floating docks in existence, amongst which five have over 10,000 tons lifting power, whilst England has more than one over 400 ft. long. The admiralty dock book indeed affords very good evidence of the way in which the floating dock is gradually acquiring favor and supplanting its older rival. In the edition published in 1890, floating docks represent only 17 per cent. of the total number of docks proper as apart from slips, whereas out of the new docks built in the decade following this date the floating dock represents 28 per cent.

"Dealing with our own contributions, we have at the present time in our offices plans for docks actually in course of construction of which the aggregate lifting power totals up to over 67,000 tons, and of which the total length, if placed in line, would be well over half a mile. As regards the size to which floating docks have now attained, we may also mention that at the present time there exist or are approaching completion no less than three floating docks whose lifting power is in each case over 17,000 tons. one of 15,000 tons, one of 12,000 tons and two of over 10,000 tons. These seven docks can hardly be said to be of 'small dimensions.'

"But apart from the general ignorance as to what floating docks there are, there is also a great want of knowledge, even amongst engineers, as to their details, such as first cost, cost of working, durability, life and general handiness and suitability to certain locations. This is doubtless largely due to the fact that the engineer who is usually called in, in connection with harbor works, is naturally a specialist in earth, brick and stone work, and is therefore more prone to solve the problem before him on the lines with which he is best acquainted than go experimenting in naval architecture, for that is the category into which the design of a properly arranged floating dock falls. It is in the hope of bringing to the knowledge of the harbor and port authorities and their advisors the fact that floating docks up to the largest size are now very generally accepted where conditions are favorable, and of setting forth clearly what are these conditions and explaining in the form of a comparison between the two types what are the special advantages that the floating dock can claim over its masonry rival, that we have decided to reprint the pamphlet referred to, shorn as far as possible of all its polemical character."

A new chart, in colors, of Erie harbor and Presque Isle, has just been issued and may be had from the Marine Review. A new chart of Buffalo harbor and Niagara river to the falls is also in print.

TRIPLE-SCREW SHIPS.*

THE MARINE RUNDSCHAU SAYS THAT THEY ARE ABSOLUTELY ESSENTIAL FOR THE GERMAN NAVY—THEIR ADVANTAGES CITED CLEARLY—ADMIRAL MELVILLE'S POSITION.

It has recently been reported from the United States that the new armored cruisers that are just about to be laid down are to have two screws, and not three like their predecessors. This report is somewhat surprising, for it is opposed to the views of Admiral Melville, the engineer-in-chief of the United States navy, who, only last year, in a very elaborate paper on "The Logical Arrangement of the Motive Power of Warships" expressed himself in favor of the three-screw system for large warships. He claims to have given the subject of triple screws much study, and believes that their employment on warships is entirely logical. In support of this, he explains fully their advantages and disadvantages, and concludes that the former outweigh the latter. Finally, he favors the arrangement of the three engines in such a manner that the central engine shall develop one-half and the wing engines each one-quarter of the total power. Though I do not quite agree with this eminent authority as to this latter distribution, I nevertheless am of the opinion that, for the German navy, the triple-screw system is the only correct one for battleships and large cruisers. While Admiral Melville, from his position, considers the advantages of this system especially from an engineering point of view, I wish to emphasize the nautical side of the question. In order to get a comprehensive idea of this question, the engineering reasons will be briefly mentioned, as this seems to be necessary for a complete review.

Ships with more than two screws have been in existence for a long time. In chapter IX of Prof. Busley's well-known book, "The New Express Steamers of the Merchant Marine and the Navy," all cases are mentioned in which three screws had been employed up to August, 1892. Some of the reasons that led to the use of the triple-screw systems therein mentioned will be referred to later; for the present it will suffice to state the principal reason that led to the adoption of three engines for the Kaiserin Augusta. It was "the possibility of reducing the engine power without involving too great a loss in efficiency, by the adoption of several small engines." This seemed to be specially necessary for steamers that do not often use their full power, but have frequently to go at reduced power and varying speeds. It was thought that, when cruising at speeds of 10 to 12 knots, the triple-screw cruisers would have their wing engines disconnected, and the center engine only in operation. When maneuvering, and when greater speed was required, the reverse arrangement was intended, and only in special cases were all three screws to be used.

The expectations that were based on this method of operation have not been realized, as the trials of the United States triple-screw cruisers Columbia and Minneapolis and our Kaiserin Augusta have shown. With the exception of a single condition, which, however, has nothing to do with the general efficiency, the use of the central screw alone is scarcely mentioned nowadays. That the triple-screw ships are especially economical for longer distances, at cruising speeds, when they use the wing engines only, is, however, unquestioned. For ships operating in squadron, we must consider almost exclusively the use of all three engines. In this case it has been found that, at low speeds, the coal consumption of triple-screw ships is somewhat greater than that of twin-screw ships, while at higher speeds it is the same. It is, therefore, necessary to try to make the triple-screw system more efficient for the more frequently occurring condition of cruising speed. Another objection to the installation of three engines is that a somewhat lower speed is obtained than with two engines for the same total power expended. This, however, had been clearly foreseen, and it was not expected, as has sometimes been stated, that higher speed would be obtained with three screws.

MACHINERY MORE COMPLEX AND DIFFICULT OF SUPERVISION.

In addition to the above two disadvantages there is another of great military importance, and that is that the entire installation is more complex and more difficult of supervision. The machinery installations of modern warships are of such complexity that an increase in this direction must always be regarded as a great disadvantage. It is evident that the entire pipe system for three engines must be much more complicated, the signaling apparatus more intricate, and the number of auxiliary engines more numerous. In regard to the latter condition, however, a rather favorable circumstance should be mentioned—that some of them can be quite comfortably installed in the after engine room, whereas, with two large engines side by side, room must be found in other parts of the ship. A greater objection than all three, however, is that the supervision of all machinery is much more difficult for the engineer in charge with three engines than with two. This also depends largely upon the space that can be given up to the various engines, and may accordingly be more or less annoying. For instance, in the battleships of the Kaiser class, these conditions cannot be regarded as anything but very unfavorable. This complexity of the triple-screw system is such a great objection that it should not be increased under any circumstances; but this would happen if the proposition of Admiral Melville to put in an unequal distribution of power for three screws were followed. Further comment on this is probably unnecessary.

A further disadvantage in the use of three screws is that the whole engine space requires more room lengthwise, say from two to three frames. In consequence of this, the heavy after turret must be placed still further aft, which involves a larger amount of broadside armor for that part of the ship which is between the two large turrets. In the new ships of nearly all nations this armor reaches part of the upper deck and part to the gun deck. The increase in weight is made up by the smaller weight of the triple engine machinery, as previously mentioned; for the latter is always lighter than the installation of two engines. Though of less importance, it may be mentioned that three engines are more expensive to keep up than two engines. I do not attach much importance to the further objection to three engines, that a larger personnel is required for attendance.

A more serious objection may be urged against three screws on constructive grounds, due to the difficulty in securing a good construction of the stern. Twin screws are placed at either side of the stern post, from which the rudder can be easily and securely suspended. If a third screw is added, it must be arranged like the screw of a single screw ship. Its shaft must pass through the stern post, and the screw itself must be placed immediately aft of the stern post, while a special post must be arranged for the rudder aft of the screw. For this post, or for the rudder, a special support is necessary, and it must be of strong, and, therefore, of heavy construction. As is well known, such a support is not a very desirable addition, especially when it forms the lowest part of the ship. It has, therefore, been arranged in the more recent triple-screw ships to dispense with this, and to merely suspend the rudder from a post that is specially constructed for the purpose. To better protect it from injury, it can be built so that its lowest point will be above the bottom of the ship's hull proper. I do not believe that the effect of the rudder is thereby diminished. If it were, the rudder might be made correspondingly longer; and, further, it will be shown that the excellent efficiency of the rudder with the triple-screw ship depends entirely upon the action of the center screw. It is admitted that there is great difficulty in obtaining a good and secure suspension of a rudder that is supported only from above. The stern frame, as is well known, is supported by the central portion of the ship, and is, therefore, greatly exposed to the vibrations of the engines. The difficulties are not insurmountable, as I have been assured by naval constructors. As a proof of this, the alterations to the rudder of the Victoria Luise may be mentioned. She lost her rudder support, and it was not replaced; the post, and the other parts from which the rudder was suspended, were merely strengthened, and, on the trials following this alteration, the arrangement of the rudder was found to be perfectly satisfactory. The difficulty in well and securely arranging the rudder, when three screws are used, cannot, therefore, be regarded as of such great importance as to justify serious objections to the triple-screw system.

SOME OF THE ADVANTAGES OF THE TRIPLE-SCREW SYSTEM.

To offset the above disadvantages of the triple-screw system there are numerous important advantages. First of all, it will be apparent that with three engines at disposal the assurance of working the entire machinery plant is greater than with only two engines. This advantage may be of special significance in battle. If from any cause, either internal or external, an engine is disabled, there still remains two-thirds of the entire power, while in case of the disablement of one engine where there are but two screws, one-half of the entire engine power is lost. This will be referred to later. Many advantages result from the smaller dimensions of the machinery by reason of the division of the power into three parts. As an illustration, let us assume a special case. Let the question be whether a battleship of about 12,000 tons, with engines of 15,000 H.P., shall have two or three screws. These are about the proportions that obtain with our recent battleships. In one case there are required two engines of 7,500 H.P. each, and in the other three of 5,000 H.P. each. It is evident that the three smaller engines can be built simpler and lighter than the two larger ones; and it may also be mentioned that the smaller engines are cheaper. All their details of wrought or cast material will be smaller, can be manufactured more easily, and are more likely to be free from defects. While the consequences from a failure of one engine are of less importance, it follows also that such failures are less likely when smaller engines are used. With the steam pressure now used, it is possible to build an engine of 5,000 H.P. with three cylinders, while one of 7,500 would necessitate four cylinders. While I do not wish to assert that four cylinder engines will never satisfy the high requirements demanded of them from a military point of view, nor have the handling qualities required in the engines of a battleship, it is certainly true that three-cylinder engines satisfy the requirements much better in this regard. The advantage of the triple-screw system in this respect is, therefore, not to be underestimated. The fact that smaller engines are more easily managed and supervised requires no argument. From a purely engineering standpoint there are further advantages of smaller engines, for which I would refer to Admiral Melville's paper, and now proceed to a consideration of the constructive advantages.

To obtain high speeds it has been found necessary to design ships with very fine lines aft, because the water displaced by the vessel will thus find easy egress, and have better access to the screws, thus securing better efficiency. But in a vessel that is fine aft, it is much easier to arrange for three smaller engines, of which the central one is aft of the others, than for two large ones side by side. The latter have to be placed much farther forward, and while this, as already mentioned, has some advantages, it is, on the other hand, very unfavorable for the propeller shafts. These have to be much longer, and will, therefore, be much more subject to torsion and to bending strains when the vessel is pitching. With engines in a fine afterbody, the foundations are very much lighter, because the frames are placed much nearer together and can, therefore, support them to better advantage.

A further advantage of smaller engines is their lesser height. This affects, on the one hand, the draught of the vessel, and on the other, the armor for the engines. The lesser draught that can be obtained with three smaller engines was the first reason for installing them. This reason still exists, and is of special importance for navies that have to consider shallow waters, which is especially the case with the navy of the United States. Besides, it must not be forgotten that each inch of additional draught calls for greater engine power to obtain a given speed.

As regards armor protection, the situation is best illustrated by a comparison between our Hertha class and the English cruisers of the Arrogant class. These two types are of approximately the same size, and have equal engine power. While the three engines of our ships have been placed below the uninterrupted protective deck, the engines of the English ships project above it, and had to be protected by a special armor shield. Therefore, the protective armor for an installation of three engines is simpler, lighter and cheaper than it is for one of two engines. Whether in this special case it would have been possible to install below the protective deck two engines of 7,500 H.P. each, on the comparatively light draught that is required for our navy, I very much doubt.

NAUTICAL ASPECT OF THE QUESTION.

We have now reached the nautical aspect of the question. A great many circumstances might arise under war conditions which would

*Translated for the Journal of the American Society of Naval Engineers by A. H. Raynal, associate member of the society.

emphasize the advantage of better protection of the machinery of a triple-screw ship. But, as such considerations are more or less theoretical, each one may indulge in them according to that part of the subject in which he is most interested. For me it is more important at present to point out the tactical advantage of the triple-screw system based on practical experience that has so far been gained on the Kaiser Friedrich III, the first triple-screw battleship that has been assigned to service with the home squadron. For a clearer understanding of the subject of "ability to maneuver," the following particulars of this ship are given: Kaiser Friedrich III has a ratio of length to breadth of 5.6 to 1, (Brandenburg has 5.4, Sachsen 5.4 to 1.) The after body of the ship under water is rather fine. The wing screws are covered by the hull. The rudder is half balanced, similar to those of the Brandenburg class, and rests upon a support below the central screw. The steering engine is worked with surprising ease through operating gear that is supported in ball bearings along its entire length. The engines are triple-expansion, with three cylinders, the wing screws turning outward and the center one left handed. The convergence of the shafts of the former is such that their axes prolonged would meet within the ship about 130 ft. from the bow.

	Friedrich III.	Brandenburg.	Sachsen.	Baden.
Number of screws	3	2	2	2
Displacement	11,130	10,033	7,400	7,400
I.H.P.	13,000	9,000	9,600	6,200
Speed	18	16	14	17.3
Bunker capacity	650	800	700	700

Friedrich III cruised with the Brandenburg and the Sachsen, and excellent and extensive opportunity was given for comparing them. Besides, there were on board of her two experienced officers who had commanded vessels of the Brandenburg class, and watch officers who had served as such on the Baden. The following account of the evolutions is based upon the unanimous statements of these officers.

Primarily the objection has been made to triple-screw ships that, were they introduced, it would be necessary to give our officers special training in handling them if they had only been accustomed to handling twin-screw ships. This objection falls to the ground when we consider that we now have ten battleships and nine large cruisers with three screws, either completed or in process of construction, and that, in the near future, as far as can be seen, our first squadron will consist entirely of ships of this type. The good nautical qualities of the triple-screw system consists mainly in the excellent steering of the ship. With a judicious use of the helm, the ship is very steady, and the keeping of a given course presents no difficulties; and it must be added that new helmsmen learn to steer with exceptional ease and rapidity. The merit of this good steering quality lies solely in the third screw, because, situated as it is just ahead of the rudder, it projects the water right on to it. Since twin-screw ships do not act so favorably in this respect, it may be stated as a fact that a great advantage of the triple-screw system consists in ability to steer well, and that with it steering is easily learned.

It is well known that single-screw ships steer well when their engines are going ahead, and this is probably responsible for the opinion at first expressed, that a triple-screw ship in her entire behavior approximates the action of a single-screw ship; that like it, in all maneuvers, it is dependent upon its rudder alone. To this we offer decided objection. The Kaiser Friedrich III was always handled as a twin-screw ship, the center screw always turning ahead, and thus exerting a favorable influence upon maneuvering, by its action upon the rudder. If, when lifting anchor, or casting off from a buoy the ships had to be turned, say sixteen points, to enter upon the course ordered, it was always found that the Kaiser Friedrich III performed the evolution quicker and in less space than the Brandenburg class, and at least as well as the Sachsen class. On the other hand, it is true that the motion of the wing screws does not have such an immediate effect upon the turning of the ship as in a twin-screw ship. If it becomes necessary to make a sharp turn at the commencement of a run of greater or less duration, the stopping, or even the backing of the center screw, has no very noticeable effect upon the turning movement. On account of the otherwise excellent turning qualities of the three-screw ship, which answers the helm almost immediately, this circumstance has never appeared to cause annoyance when in squadron.

Furthermore, the following evolution was executed: The ship lay at the south wharf of the fitting-out basin at Kiel dock yard, west of the passage to the building basin, heading east, and left the wharf without using the lines that were got out. It is true there was no wind, but I doubt that a single screw ship of the same size could have performed this evolution under the same conditions. It should also be noted that the fitting-out basin was not empty, but that there were two or three large vessels lying close to each other on its north and east sides. On the other hand, in backing, steering by means of the screws, especially under unfavorable conditions of wind, is exceedingly difficult. But in spite of this, it may be said that the Kaiser Friedrich III has left the wharf at Kiel backing under the most trying circumstances, and that they always succeeded in taking her to the desired place. However, as regards the lesser effect of the wing screws, it must be stated emphatically that this is only a consequence of the convergence of the wing-screw shafts, which approach so closely forward; and, therefore, it must not be assumed to be an objection to the triple-screw system in general. This convergence of the wing-screw shafts is due to the comparatively small beam of the ship, which necessitated this construction. Where this is not required, as will be the case in our battleships, and when the wing shafts are parallel to the plane of the keel, the effect of their screws would be the same as in a twin-screw ship. With the increased engine power, I would suppose it more probable that, with three screws, the wing screws could be more easily arranged with parallel shafts than with the larger screws of only two engines. If this assumption is found to be correct, then the effect of the screws in the latter case would also be less. At any rate, as has been mentioned, the objection to their projection beyond the ship's side cannot be removed. The conclusion to be drawn from this is that the triple-screw ship with parallel shafts is superior to the twin-screw ship in ability to maneuver.

THE MATTER OF CASUALTIES IN BATTLE.

It only remains now to mention briefly the influence of casualties in battle, to either rudder or engine, in a triple-screw ship. In a twin-screw ship, if one engine is rendered inoperative, only one-half of the entire engine power remains for propulsion. The helm has to be put over from five to ten degrees towards the side of the injured engine in order to steer a straight course, by reason of which a part of the speed, even though a small one, is lost; but the ability to maneuver suffers to a great extent. The three-screw ship, however, loses only one-third of her engine power, with a corresponding reduction in speed, when one wing screw is put out of action. The steering is hardly affected, because the central or steering screw remains intact. If the rudder gets out of order in a twin-screw ship it is necessary to steer with the screws, by which more or less speed is sacrificed, according to the evolution. If, however, the triple-screw ship becomes rudderless, she can be steered with the wing screws; and even with the unfavorable arrangement of the wing shafts on the Kaiser Friedrich III this can be done without any special difficulty. But there the entire power of the center screw is available for the forward motion. Therefore, in these battle casualties, three screws are more advantageous than two.

If I were to condense all that has been said before, I should come to the following conclusions: The three-screw system has weighty arguments in its favor from a mechanical standpoint, but there are also some against it that should not be underestimated. It appears to me that the advantages exceed the disadvantages, although I am fully aware that others hold a contrary opinion. However, from a nautical standpoint, the advantages are so great that I consider the use of three screws on large battleships absolutely correct. And this point of view must be the controlling one in the solution of the question. The majority of our technical officers would be of my opinion in this matter.

But if it be asked how the other great navies stand in regard to the use of three screws, it must be said: The United States is again building only twin-screw ships; opinions there are, however, much divided. Russia is still wavering; in her new large ships we find two as well as three screws. In France, all new battleships and large cruisers are fitted with three engines. The British admiralty has vigorously opposed the triple-screw system, which is astonishing.

It would be manifestly wrong to form opinions against the triple-screw system from merely sentimental considerations; and yet there are officers who, without having had an opportunity of becoming familiar with three screws, and who, without being able to mention any special point against them, believe that the triple-screw system can not be good, because—the English have not yet adopted it. England is inordinately conservative and holds on to old methods. It was only after the French had built ironclads and had successfully tried them that the English decided to change their "wooden walls" to iron ones; and they were many years behind other navies in adopting breech-loading rifles. Admiral Melville mentions in his paper the fact that no English warship has three screws, and seeks an explanation in the fact that English constructors do not have to deal with light draught to the same extent that the American constructors do.

THREE-SCREW SHIPS SUITED TO KAISER WILHELM CANAL.

But whatever reason may exist for the astonishing fact that the triple-screw system has not yet been introduced in the British navy, there is a strategical reason for the use of three screws by us. It is this: A three-screw ship can pass through the Kaiser Wilhelm canal with great ease. It is true that our other ships have passed through it, but the demands upon their management were entirely different. Whoever, for instance, has passed through the canal, first in the Baden and shortly afterward in the Kaiser Friedrich III, must have been impressed with the immense advantage that the three-screw ship has over the two-screw one. On the Baden the best helmsmen were steering, and in spite of this the officer of the watch had repeatedly to help out with the engines in order to keep the ship on her course. He could not for a single moment withdraw his attention from the steering of the ship, which fact made it necessary for the officers to be relieved every two hours during the passage. The conditions on the Brandenburg class were similar, though somewhat better. It must be added that these ships, and it is probably the case with all twin-screw ships, cannot exceed a certain number of revolutions, determined by experience, otherwise they have a tendency to run away from their rudders and thus cause damage to the banks of the canal by the increased stern wave.

The passages through the canal with the Kaiser Friedrich III were entirely different. She was brought through the locks without any thought of damage to the wing screws. After leaving them, the wing engines were stopped and the center engine proceeded with just as many turns as were necessary for the prescribed speed through the canal. In this way this ship of 11,000 tons went through the canal as easily as a small boat. There was no intense attention by the officers of the watch, no anxious walking hither and thither of the navigator. The engine telegraphs were not touched; quiet and peace prevailed on the bridge. The speed was low for a vessel of such large displacement, and might have been increased with safety without lessening the good steering qualities of the ship, and without injury to the banks of the canal, for there was hardly any stern wave. It is to be hoped that trials of this nature will soon be made.

The Kaiser Wilhelm was built primarily for strategical reasons, and, as far as can be seen, it will play a great role in any naval war with Germany. Is it not, then, self-evident that we should employ all aids that are given with the triple-screw system to make a quick passage, if necessary, without regard to the canal, and one that is safe under all circumstances? If our new battleships had twin screws it is more than probable that they could never pass through the canal or the locks without injury. And what would be the conditions if such ships had just been commissioned and were without an experienced crew?

If the advantages of the triple-screw system from a nautical standpoint have caused me previously to declare in favor of them for general use, it follows from a consideration of these last conditions that, for the German navy, it is absolutely necessary to fit all the large ships of the home fleet with three screws.

New train east via B. & O. R. R.—Leaves Cleveland 11:20 p. m. daily with through sleeper to Pittsburg and observation chair cars to Washington, Baltimore, Philadelphia and New York, giving daylight ride through the mountain scenery. June 30.

NATIONAL ASSOCIATION OF MANUFACTURERS.

THE ANNUAL ADDRESS OF PRESIDENT THEODORE C. SEARCH IS A FORCEFUL ONE—NECESSITY FOR THE UP-BUILDING OF THE AMERICAN MERCHANT MARINE.

The sixth annual convention of the National Association of Manufacturers is being held in Detroit during the present week. The address of the president, Theodore C. Search, of Philadelphia, was a masterful effort and is given below in part. He said among many things:

"We are living in an era of such momentous changes that it is unsafe to hazard predictions of what is to come next. We have been accustomed heretofore to regard the past and present as a safe basis upon which to forecast events likely to occur in the future. Within the past two years, however, we have witnessed such an overturning of precedents, such a procession of unexpected happenings in defiance of apparently well-founded prophecy that we are led naturally to the conclusion that a new era and a different order of things have come upon us within this century. The accumulated experience of the past hundred years seems to avail but little in determining what may or may not happen next in the progressive march of our country. The United States has ever been a surprise to the rest of the world in the century and a quarter that have elapsed since the colonies began doing business on their own account. We have ever been credited with startling originality in the methods of our industry, our commerce and our politics, and we have given many a rude shock to the established theories by which the world has attempted to measure our capabilities and to forecast our future.

"With our entrance upon another century, however, surprise has become reactionary, and probably no people have been more astonished than ourselves at what we have accomplished, what we are now doing and what we are undertaking with entire confidence of success. Industrial enterprises are being conducted upon a scale of magnitude that would have appalled even the most imaginative minds of a few years ago; commercial operations have assumed proportions so far in excess of all precedents that we can find no basis for comparisons, while American transactions in finance have sharply shaken the prestige of London as the world's money center.

"A year ago all of us were straining our vision in efforts to foresee the future, to determine how far and how long these conditions of prosperity would continue; and the lapse of twelve months apparently has brought us no nearer to the point from which the end can be seen. There seems to be no waning of the general prosperity of the country, and conditions that could breed panics are not manifest as yet. An analysis of conditions the world over shows many changes as compared with the situation at the beginning of last year, and such a broad view is essential to a proper understanding of our own position and prospects; for we are no longer a self-sufficient and independent nation, but our interests are closely interwoven with the affairs of all the world. This broader dependence upon other nations tends to greater stability in our industries and our commerce, for it is hardly conceivable that all countries could be affected similarly and simultaneously by any depressing influences.

"Thus, while Germany may be suffering from reaction and consequently buying less of our wares, South Africa is emerging from the troubles of war and China is being reopened gradually to trade under conditions of greater promise than ever seen before. While there was a shrinkage of nearly $10,000,000 in our exports of raw cotton to Japan during the nine months ending March 31, 1901, there was an increase of about $75,000,000 in the exports to Great Britain and Europe. At all times the markets of the world are undergoing some process of gradual readjustment; and the trade that is lost to us in one country is made good by the increasing demands of another. It was this wide distribution of our foreign trade that made possible an increase of over $43,000,000 in the exports of manufactured products during the fiscal year which ended June 30, 1900, and a continuance of this enlarged volume of foreign business during the past nine months."

To impress the magnitude of the export trade of the United States more forcibly upon the members of the association, Mr. Search presents from records of the treasury bureau of statistics a table which shows the growth of the total exports and the exports of manufactured articles from the United States since 1821, from which it is noted that our exports of manufactured products have increased in the past five years to the extent of $250,000,000 per annum out of a total increase in exports of about $577,000,000. The percentage of manufactures to total exports in 1900 was 31.65, against 23.14 in 1895, 17.87 in 1890, 12.48 in 1880, 12.76 in 1860, 12.85 in 1840, and 12.88 in 1821. Continuing, Mr. Search says:

PLEA FOR COMMERCIAL RECIPROCITY.

"The most serious problem that now presents itself in relation to the export trade of the United States concerns not only the further extension of this trade but also the preservation of the business already established. Heretofore it has been comparatively easy for American manufacturers to secure foreign business whenever they have put forth serious effort to get it. Emergencies of unusual activity in England and Germany, which have debarred manufacturers in those countries from aggressive competition, have made it possible in many instances for American manufacturers to secure with little effort orders which under ordinary conditions could have been taken only by a struggle. Then, again, American competition has not been regarded abroad as a very important factor in international trade by those who have encountered it. These conditions have changed very materially during the past year and will be altered still further in the near future. Instead of a free field and open markets we are likely to encounter obstacles that will hinder very seriously the further extension of our foreign trade and threaten that which is already established. Decreasing industrial activity and declining prices in many lines, particularly in Germany and Great Britain, are making American competition oppressive where its force was not felt when business was abundant for all. Europe has suddenly awakened, too, to a realization of the vast competitive strength of the United States, and those who formerly were amused and entertained by American aggressiveness now are alarmed by our encroachment upon the markets which they have regarded as their own. All of this indicates that new conditions will be encountered and new problems will have to be solved in our commercial relations with other nations.

"The expansion of the territorial limits of the United States has given rather a sharp wrench to our governmental organism, and the extension of the field of our commercial operations is likely to give a no less severe shock to the economic policy which has made possible the marvelous industrial and commercial development of the nation. So long as it was necessary to consider only the needs of the country, its industry and its commerce, it mattered not what other nations thought or said of the American protective policy. That they considered as selfish what we deemed patriotic did not concern us. The practice of getting all that could be had and keeping all that was obtained was eminently a proper principle upon which to proceed with the development of the nation's industries within the limits of the domestic market. Having crossed the seas with goods to sell, and having begun a business that has amazed foreign competitors, we are confronted with new conditions, and we find that the outer view of our economic policy differs somewhat from its appearance on this side. A century of history has demonstrated the marvelous efficiency of the protective policy for the creation of a great and prosperous industrial nation. Other nations, profiting by our experience, adopt the same policy and barriers rise to impede our commercical progress abroad.

"What shall we do under these conditions to preserve our export trade and open the way for its further expansion? Shall we abandon our protective system and ask other nations to give us equally free admission to their markets? Not for a moment should we consider such a step. It would be neither safe, expedient nor practical in accomplishing the desired purpose. If Germany seeks industrial advancement through a protective policy, far be it from us to object to the fullest enjoyment by others of that which has given us so great prosperity. If Russia undertakes to plant factories throughout her vast domains, we should be the last to criticize her adoption of the methods that have proved so successful here. Conditions which now confront us in our foreign trade present the opportunity and impose upon us the duty of readjusting our commercial relations with other countries upon such a basis as shall insure freer intercourse without any sacrifice of material interests by either party. To put it in a word, reciprocity is the one factor that is of the utmost value to us in the present stage of our export trade. For twelve years past, ever since James G. Blaine attempted to bring the nations of the two Americas into closer union by the application of this principle, reciprocity has been a favorite topic of discussion by economists and business men as well. Belief in the potency of this principle, however, has been based more upon prophecy than upon experience; but now as never before do we see plainly before us conditions which call for the immediate practical application of commercial reciprocity. We see industrial Germany aroused and alarmed by the encroachment of American competition, not in foreign neutral markets, but in the midst of the empire where our manufacturers have been selling their machinery and products as never before. We see Russia incensed because her friendly efforts to secure commercial courtesies in return for valuable concessions extended to us have been cavalierly ignored and great injustice done to her. France has waited patiently for nearly two years to give us abundant time to consider propositions touching mutual trade concessions; but even such courteous forbearance hardly may be expected to continue without end. Even Austria and Switzerland, of less importance to us from a commercial standpoint, are expressing with much emphasis their dissatisfaction with our national policy which seeks to obtain all possible trade advantages and yet is unwilling to concede any favors in return.

"To my mind there is no more important work to which the National Association of Manufacturers can apply its energy and influence in the immediate future than an effort to induce the senate of the United States to give favorable consideration to treaties of commercial reciprocity submitted for approval by that body. The position in which the people of the United States find themselves is humiliating. After reiterated expressions of desire for reciprocity treaties, after the added emphasis given to these requests by successive presidential messages, and even after the creation of special machinery within the department of state for the negotiation of such international agreements, we find all of these efforts made of no effect by the refusal of the senate to give consideration to the treaties presented for ratification. And the special plenipotentiary of the state department abandons his work and resigns his office because of the evident futility of the undertaking. Here is a problem which can well command our most serious attention and our most determined efforts. The continuance and further extension of our magnificent export trade in manufactured products depends more upon our willingness to barter privileges with our foreign customers than upon any other influence that we can discern at the present time. We can yield much that will be of value to others without causing loss or injury to our own interests. If we are not willing and able to adopt such a policy we must expect not only the loss of privileges we now enjoy but also open retaliation as a punishment for our selfishness.

"As the first practical step let us urge the senate to ratify the treaty of commercial reciprocity with France, so long delayed, so repeatedly postponed, but still alive. True it is not an ideal measure, so far as its provisions are known to us, but I believe it to be vastly better than nothing and a step in the right direction. It is better for us to have this treaty put into operation, trusting to an agreement embodying everything anybody desires with the subsequent amendments to remedy its defects, than to insist upon probability that it will be lost in its entirety. Something is always better than nothing, and it is wiser to take what we can get than to ask for too much and get nothing. There is need for vigorous and continued effort to bring about the practical application of the principles of reciprocity in our commercial intercourse with other nations."

President Search reviewed at length the commercial complications which caused Russia to place a tariff upon American steel products. The difficulties with Russia give additional emphasis, he said, to arguments in behalf of reciprocity. Extended reference to the subject was due largely to the important part which the National Association of Manufacturers has taken in efforts to adjust the difficulties. Legislative work of the association is also referred to at considerable length, and Mr. Search asks the members to remember that visible results do not measure the extent or efficiency of this work. Every legislative measure which

the association has undertaken to support is one of great magnitude and importance and precipitate action by congress would hardly be expected. While it is not possible to measure the work which the association has done in this direction by any list of new laws enacted, it must be obvious to any one who is in close touch with the situation in Washington that the association has made itself very strongly felt there and that its influence is recognized and respected. The bill in congress for incorporation of the association was defeated, Mr. Search says, by opposition on the part of members from states in which manufacturing interests do not predominate. He recommends the appointment of a committee to make careful revision of the proposed act of incorporation and to present a revised bill to the fifty-seventh congress as new matter. On the important question of our merchant marine in the foreign trade, the president of this great organization says:

RESTORATION OF THE AMERICAN MERCHANT MARINE.

"No measure that failed ultimately on its passage occupied so much attention of the fifty-seventh congress as the shipping bill. It was generally believed that a clear majority of both houses would cast its vote for the adoption of this measure after the many amendments to which it was subjected during the session; but by reason of prolonged discussion it failed to come to a vote. Discussion is hardly the proper term by which to designate the obstructive tactics of the opponents of this measure; for with the sole and avowed purpose of consuming time until adjournment, the opposition in the senate talked about every other subject but the shipping bill under the pretext of analyzing and discussing the provisions of the measure. The postmortem examination shows very clearly that the shipping bill was talked to death.

"At the coming session of congress it is certain that a measure of similar purpose will be introduced and that the effort to promote American shipping and American commerce by a judicious system of governmental aid will be renewed with added vigor and determination, and we may reasonably hope that the obstructive tactics practiced during the last session will not be permitted to prevent a fair and full discussion of this question. With the steadily increasing sentiment favorable to such legislation that is manifest not only throughout the country but in congress itself, there is justification for the belief that fair treatment of the measure will permit its passage.

"The needs of our merchant shipping have been argued before you so frequently and so fully that it hardly seems needful to repeat these arguments at this time. We are all agreed with regard to the necessity for such legislation as shall encourage the expansion of our merchant shipping and its establishment upon the same plane of prosperity that is occupied by our productive industries. In striking contrast with the rapid expansion of our manufacturing interests is the absence of growth in our merchant shipping. The extraordinary increase in our foreign trade adds largely to the traffic and profits of the steamship lines which carry our goods abroad under foreign flags, but we have no ships of our own to share in these benefits. It is pointed out that the building of ships in the United States was never so active and profitable an industry as at present, but this signifies nothing, so far as our ocean-carrying trade is concerned, for nearly all of the new shipping built in American yards is for coastwise trade or for internal waterways. The few ocean-going steamers that have been built or contracted for in the United States have been ordered in the belief that congress would enact such a law as would make it possible for American-built ships to compete successfully for their share of the world's carrying trade. In fact orders for many ocean steamers have been given to builders but made conditional upon such legislative action.

"The situation has been confused somewhat by the recent transfer of vast British shipping interests to American ownership; but those who see in this incident any evidence of American ability to conduct ocean-carrying trade without governmental aid have only a clouded view of the facts. American ownership of foreign-built vessels sailing under flags other than our own does not in any sense constitute American shipping any more than the investment of English capital in the securities of our railroads makes our transportation lines British enterprises. So long as the ships that carry our goods to and fro across the ocean sail under foreign flags our merchants, our manufacturers, our farmers and our miners will fail to enjoy the advantages that would accrue from the existence of a great fleet of steamships that are American in all that the term implies. Let no friend of our merchant shipping be misled into the belief that the investment of American capital in British steamship lines is a step towards the realization of those hopes which center in the development of our merchant shipping.

"As yet we can not build ships as cheaply here as abroad, nor when built at any cost can we operate them under the American flag as economically as those which fly the colors of other nations. What hope, then, have we for successful competition with foreign ships unless our government shall do for our merchant marine what it has done with such eminent success for our manufacturing industries—place our ships on a footing where they can meet foreign competition with disadvantage. There is a strange inconsistency in the reluctance of our government to apply to its shipping the same policy of protection that has been extended unhesitatingly and with magnificent results to its productive industries. This discrepancy seems all the more strange in view of the fact that every other maritime nation recognizes the need and the merit of such a protective policy, even though disowning belief in the principles of protection in general.

"It is hardly expedient for such a body as this to undertake the formulation of its ideas with regard to the exact details which should be embodied in a law of this character. All that this convention can do, during the congressional interval while no bill is under consideration by congress, is to express in most emphatic terms its belief in the general principle of government aid to our merchant shipping, leaving it for the officers of the association to determine by their best judgment and discretion the form and manner in which aid shall be given to the whole movement.

DEPARTMENT OF COMMERCE—INTERSTATE COMMERCE LAW.

"There is a manifest growth in the sentiment which favors the creation of a department of commerce and industries. Legislation for this purpose was delayed during the past session of congress by the same influences which operated to obstruct all congressional action. A carefully prepared bill is in the hands of Senator Nelson of Minnesota, who is well known for his painstaking and successful conduct of every undertaking committed to his care. The provisions of this measure, which will be presented for the consideration of congress during its next session, are practically identical with previous bills of the same purport, and it is not necessary for me to repeat them on this occasion. It seems sufficient to suggest that the association reaffirm its belief in this principle and renew its pledge of support to the movement that has been so long under way, urging congress to take early and favorable action.

"The passage of certain amendments to the interstate commerce law, embodied in what was generally known as the 'Cullom bill,' was most earnestly advocated by various commercial organizations, and a large volume of information was secured by the senate committee bearing upon this particular act of legislation, with the result that the committee rejected the measure and returned it to the senate without recommendation. The bill made no further progress and the subject is now open for renewed consideration in the light of the remarkable developments that have taken place in connection with transportation interests in the past year. A combination of the larger railroad corporations of the country in what is generally known as a 'community of interests' has so far simplified and modified competition between lines as to render it improbable that the railroad companies will demand again the privilege of pooling. It may be said, therefore, that this vexatious disturbing element, upon which the commercial community was seriously divided, has been eliminated from the question. So far no definite proposition looking to amended legislation has been introduced to take the place of the 'Cullom bill.' If the subject of amending the interstate commerce law shall be discussed again, it will probably be upon the lines of increasing the power of the commission, a proposition against which will be arrayed all the power, influence and intelligence of the common carriers of the country. This is a question that is worthy of the most careful and serious consideration by the manufacturers of the United States, whose interests are so closely interwoven with the great industry of transportation.

IMPROVEMENT OF THE CONSULAR SERVICE.

"Several measures looking to the improvement of the consular service of the United States were introduced during the last session of congress, but the demands upon congressional attention by bills of more urgent public importance prevented any of these measures from progressing beyond the committee stage. Inasmuch as new bills will be introduced during the next session it is not necessary to consider in detail any of the bills presented during the last session. There can be very few among us who have had opportunities to study the work of our consuls to learn of the condition under which they labor, and to make comparisons with the consular service of other nations, without reaching the conviction that there are many defects in our consular system which call for correction. There has been a marked improvement during the past few years, both in the character of men who occupy consular positions and in the efficiency of the work they are doing. This is due, however, not to any reform of the system itself but to the exercise of more conscientious judgment in the selection of men. So long as our consular service shall be maintained upon its present basis, subject always to presidential selection and senatorial confirmation, it can be hardly possible to look for any elevation of the service except by appeal to the powers that appoint and confirm. The idea that the consular service is a legitimate agency through which to reward political services has become so firmly established that any effort designed to remove the service from politics and to conduct it upon strictly business lines is bound to meet with much apathy in congress, if indeed it does not encounter most determined opposition. There is no reason, however, why we should desist from our efforts to place this exceedingly important branch of the government upon a more efficient basis. The watchful care of this association can do much towards bringing about the desired end. The apparent lack of success thus far should not deter us from continuing our efforts with all vigor and hopefulness."

The remainder of the address was devoted largely to routine work of the association.

VESSELS BUILT AND OFFICIALLY NUMBERED.

The bureau of navigation reports that 1,024 vessels of 359,789 gross tons were built in the United States and officially numbered during the eleven months ended May 31, as follows:

	WOOD.				STEEL.				TOTAL.	
	SAIL.		STEAM.		SAIL.		STEAM.			
	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.
Atlantic and Gulf	414	69,001	175	10,314	9	10,320	42	80,250	640	169,885
Pacific	50	23,991	79	10,044	.....	.....	6	7,607	135	41,642
Great Lakes	6	116	40	4,824	5	11,236	42	121,757	93	137,933
Western Rivers	57	1054	98	8,713	.....	.....	1	562	156	10,329
Total	527	94,162	592	33,895	14	21,556	91	210,176	1024	359,789

During the corresponding eleven months, ended May 31, 1900, sail and steam vessels of 264,929 gross tons were built.

During May of the present year 143 vessels of 49,657 gross tons were built, as follows:

	WOOD.				STEEL.				TOTAL.	
	SAIL.		STEAM.		SAIL.		STEAM.			
	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.
Atlantic and gulf	53	4,775	22	1,053	2	308	11	18,505	88	24,641
Pacific	5	2,618	14	1,750	.....	.....	1	1,554	20	5,922
Great lakes	1	8	7	703	.....	.....	8	17,403	16	18,114
Western rivers	7	137	12	843	.....	.....	.....	.....	19	980
Total	66	7,538	55	4,349	2	308	20	37,462	143	49,657

ENCOURAGING OPPOSITION TO NAVAL INCREASE.

The New York Sun says that the opponents of liberal appropriations for the navy are likely to have a powerful weapon during the next congress in the delays that have ensued in the construction of torpedo boats and destroyers. Of thirty-one vessels of these two types authorized three years ago only a few have been completed, although the contracts called for their delivery to the government within eighteen months for the destroyers and twelve months for the torpedo boats. Through the lenient policy pursued by the navy department liberal extensions of the contract time have been granted until the period of completion has been carried over more than a year beyond the dates set for deliveries in the original contracts, and now some of the ship building firms have again come forward with requests that there be still further extension of from two to six months. It is difficult to place the responsibility for this condition of affairs, but even if that were accurately determined it would probably increase the force of the argument which the opponents of naval increase would bring to bear in the senate and house when the next naval bill is under consideration. The fact remains that little vessels that could be completed in a year, and this is a liberal allowance of time, are now in their third year of construction. When it is said that a battleship can be completed in three years the force of the comparison is obvious. The argument that the ship yards of the country had already as many big naval vessels as they could conveniently build for several years to come, was strong enough to cause congress at its last session to refuse appropriation for any more battleships and armored cruisers, contenting itself with directing the navy department to prepare plans for some armorclads to be submitted to the two houses when they meet again in December. And there was no promise held out in the clause directing the department to this, that the plans would be adopted and the vessels authorized. It is evident that the men who were chiefly instrumental in preventing actual naval increase at the session that ended last March will not fail to obtain the additional advantage afforded by the showing of delays on torpedo craft. Their contention that the ship builders will have their hands full constructing the powerful armored ships already authorized, will, apparently, gain force by the assertion, backed by official information, that the ship builders require three years to construct torpedo boats and destroyers, the smallest types of naval vessels.

The thirty-one torpedo boats and destroyers were authorized by congress in May, 1898. In September and October of that year the contracts were awarded and in each case they required the completion of the vessel in September or October, 1899. When the contract period expired most of the contractors asked for an extension, claiming that, owing to the great boom in the steel trade, manufacturers of steel forgings had more work than they could do and were unable to furnish in time the material required for the vessels under construction. The department accepted this explanation and granted the requests for extensions, making the additional time one year, the greatest increase asked. In order to be perfectly fair, the department extended the contract period to torpedo boats and destroyers whose builders had not asked for that privilege. Later there was another increase for the reason stated in the first instance and now an additional extension of the contract period is asked by some of the contractors.

While, heretofore, the department and its advisory committee, the board of construction, had accepted in good faith the explanations made for the inability of the torpedo craft builders to complete their contracts within the specified periods, recent information has given rise to the suspicion that the prevailing prosperity in the steel trade has not been wholly responsible for the failure to construct the vessels on time. With the requests just made for further extension of the contract periods, some of the contractors have submitted explanations of their failure to obtain steel material which indicate that the steel makers are indifferent to the repeated demands that the deliveries be made. A few firms only are able to make the nickel steel shaft forgings and other nickel steel materials required by the specifications and the torpedo vessel builders are dependent on these firms. That they have the time to do this work within the period of their contracts with the torpedo boat builders is evidently believed by some of the latter. Why, in these circumstances, the steel makers have not fulfilled their obligations is not definitely known, but it is attributed in some quarters to the fact that these forgings are small and bring very little money to the makers, who, it is said, have not delayed in furnishing similar forgings of large size for the big armor clads.

The applications of the torpedo boat builders for time extensions will probably not be acted upon until Secretary Long returns to Washington, but should he follow what appears to be the prevailing sentiment in the department, an additional delay would be officially sanctioned.

A CASE LONG IN COURT.

Of all the long-drawn-out admiralty cases known to shipping interests of the great lakes that involving differences over a collision between the steamers Conemaugh and New York is probably the most famous. It has just been learned that this case is again in the supreme court on a writ of certiorari and may not be settled for two or three years more. The proceedings in court were first begun by the Erie & Western Transit Co. against the propeller New York, owned by the Union Steamboat Co., and grew out of a collision in the Detroit river between the propellers Conemaugh and New York, Oct. 21 1891. The Conemaugh was sunk and sustained considerable damage, but the damage to the cargo, about $40,000, was even greater than the hull damage. In the first hearing before United States District Judge Swan at Detroit both vessels were held at fault and the damage divided. On rehearing in the same court the New York was held solely at fault. On appeal to the United States circuit court of appeals, sixth circuit, the decree below was reversed and the Conemaugh held solely at fault. Then the case was taken to the United States supreme court on a writ of certiorari and the decree of the court of appeals reversed, both vessels being again held at fault,

We can supply promptly any ordinary order for Steel Bridges, Buildings, Roofs, Trusses, Columns, Girders, Beams, Channels, Angles, Plates, etc.

American Bridge Company

GENERAL OFFICES 100 BROADWAY NEW YORK

21-160.

but with full decree against the New York for all the Conemaugh's cargo damage. After issuance of mandate decree was entered in the district court against the New York for all the cargo damage, and the damage to the Conemaugh and to the New York was divided to these two vessels. Proceedings in mandamus were then brought in the supreme court to modify the decree so as to divide the cargo damage to both vessels. The petition was dismissed. The cause was appealed again to the circuit court of appeals on the same question and a few weeks ago that court delivered an opinion affirming the decree of the district court, which divided the damage to the two vessels but requires the New York to pay all the cargo damage. As noted above the case is again in the supreme court, this time through action of counsel for the New York. Harvey D. Goulder of Cleveland for the Conemaugh and C. E. Kermer of Chicago for the New York are leading counsel in the case.

IMPROVEMENT IN SHIP CONSTRUCTION.

No one acquainted with the subject can deny the statement that British ships are incomparably safer than they were, say, two or three decades ago. The teachings of costly experience have shown us what are safe and what are unsafe types of vessels, and the natural law of the survival of the fittest has resulted in the elimination of ships of unseaworthy proportions and the evolution of types which are—well, superior to their predecessors of twenty or thirty years back. But, at the same time, we should be more than optimistic did we not recognize that many of the mistakes and faulty methods of twenty years ago are still existent, and that then, as now, the unscientific, and consequently unseaworthy, ship was under criticism by those who were actuated by the laudable aim of safening the sea for sailors and floating properties. We are impelled to these remarks by the perusal of an exceedingly able paper which was prepared at the request of the Cleveland Institution of Engineers and read to the members on May 3, 1880. The author was Mr. Hy. Foxton Craggs of the well-known firm of R. Craggs & Sons, a gentleman, as the world of shipping is aware, fully qualified by actual sea experience, and by his ship building and ship owning business, to speak with authority on the subject of improvements in the construction of decked vessels for the safe carrying of bulk cargoes, and the provision of water ballast without loss of stowage space. To state that such a paper was necessary is to put the matter very mildly. During the eight winters preceding and including that of 1879-80, no fewer than 148 British cargo steamers, aggregating 172,605 tons, had either capsized, foundered or gone "missing." Sixty of these vessels were grain laden and forty carried coal, while sixteen were laden with iron or other ore, and fully two-thirds of this appalling loss-roll was incurred by vessels crossing the North Atlantic or the Bay of Biscay. Thus it is evident that there was an urgent necessity for some qualified person to come forward and, by suggesting remedies for this untoward condition of things, check the awful tide of disaster and life-loss.

We have no intention of discussing those suggestions of Mr. Craggs' which have been adopted, and which have played their part in safening the sea to British ships and British sailors, but would rather call attention to faulty methods then, and now, existent, and which thus afford a striking object lesson on the necessity of persistent and patient pegging away if reforms are to be effected. Speaking of the ship of 1880, Mr. Craggs remarked: "What is required is a vessel that will stow as much measurement goods, or carry as much weight cargo, as will make the best of a bad freight or the most of a good one * * * that the same ship is required to carry coals out and wheat, peas, maize, seed or other grain home; coke out and copper, iron or other ore home; Cleveland pigs or steel blooms out and oats or timber or flax or cotton home. And last, and worst of all, while all these extremes have to be dealt with in such a way as to secure the largest possible freight for carrying any one or more of these differing goods, provision must also be made for sufficient water ballast to enable the ship to make a passage across the Atlantic in the winter months."

This description might as well be that of the tramp of the year 1901 as the cargo steamer of twenty years ago, for the same practice still obtains, as we suppose it must, of building steamers to carry any or no cargo. Mr. Craggs suggested alterations of type, etc., and he also suggested a safe and unique plan of carrying water ballast both for steamers and sailing vessels. The economical benefits of water ballast were at that time by no means generally appreciated, though Mr. Martell had calculated that the average cargo steamer trading to the Mediterranean, there discharging and proceeding to the Black Sea for grain, would save £1,000 per year of four voyages by using water ballast. Mr. Craggs, discussing this pronouncement, pointed out that he saw no reason why these advantages should not be extended to sailing vessels, and yet, at the present day, the average sailer has to rely on rubbish ballast. He suggested an improved ballast tank, extending along the floor of the ship for about two-thirds its length, and reaching about one-fourth of the width of the vessel on each side of the midship line. This tank was strongly made, and was, when the ship was laden, available for cargo. Cargo could also be carried on and around it without causing it to leak when filled with water. The Isabel Craggs, built and owned by Messrs. Craggs, and fitted with this patent tank, was a most successful ship, whether laden or in ballast. Yet neither this type of ballast accommodation, nor, in fact, any other, has been adopted by sailing vessels.—Syren & Shipping, London.

Summing up present conditions in the steel and iron industry, the Iron Age says: "In view of all the circumstances the prolonged lull in buying should cause no uneasiness, because evidently the heavy consumption is going on right along. Yet it is idle to deny that buyers are acting conservatively, and the amount of new business is not large in any line, from the pig iron to the finished material."

Pan-American exposition rates to Buffalo via the Nickel Plate road—Tickets now on sale at all stations, one and one-third fare for round trip, good returning fifteen days. Write, wire, 'phone or call on nearest agent, or E. A. Akers, C. P. & T. A., Cleveland, Ohio. 85, Aug. 1.

BELLEVILLE GENERATORS

Grand Prix 1889 — Hors Concours 1900
Originated 1849 — Latest Improvements 1896

Number of Nautical Miles made each year by Steamships of the Messageries Maritimes Co., Provided with Belleville Generators—Since their Adoption in the Service.

Year.	Australien	Polynésien	Armand Béhic	Ville de la Ciotat	Ernest Simons	Chili	Cordillère	Laos	Indus	Tonkin	Annam	Atlantique
1890	67,728	2,460										
1891	68,247	68,331	204									
1892	68,247	68,403	69,822	23,259								
1893	68,379	68,343	68,286	68,247								
1894	68,439	68,367	68,574	68,439	37,701							
1895	68,673	68,766	68,739	68,808	40,887	28,713						
1896	69,534	92,718	69,696	69,549	62,205	63,153	40,716					
1897	68,250	69,606	92,736	69,555	62,235	76,110	63,357	43,146				
1898	70,938	69,534	69,552	69,597	62,526	63,240	63,240	62,553	63,954	22,707		
1899	69,534	69,615	67,431	90,405	60,246	62,778	62,868	52,344	54,855	44,007	22,884	
1900	69,534	67,494	69,744	69,564	61,719	62,382	62,502	51,471	53,373	62,016	63,066	52,140
Total	757,503	713,637	644,784	597,423	387,519	356,376	292,683	209,514	172,182	128,730	85,950	52,140

ATELIERS ET CHANTIERS DE L'ERMITAGE, À ST. DENIS (SEINE), FRANCE.
WORKS AND YARDS OF L'ERMITAGE AT ST. DENIS (SEINE), FRANCE.
TELEGRAPHIC ADDRESS: BELLEVILLE, SAINT-DENIS-SUR-SEINE.

AUSTRALIAN LIGHT-HOUSES.

Although the greater portion of the Australian coast is remarkably free from dangers to navigation, light-houses have been erected at every available point; hence the comparatively limited number of shipping disasters other than those occasioned by stormy weather. The whole of the New South Wales coast is efficiently lighted, and when the service passes into the hands of the federal government, further improvements will be effected. Some of the lights are visible at a distance of 12 miles. The most important of the New South Wales light-houses is the Macquarie, at the entrance to Port Jackson, and which ranks as one of the largest and finest in the world. It is also the grandest example of electric lighting of which the southern hemisphere can boast. The structure was begun March 1, 1880, and the light in connection with it brought into operation on June 1, 1883. The old light-house, which the new one has replaced, was built in 1816, and was the first structure of the kind in Australasia. It is equally interesting, and also illustrative of the enterprise of the state, that the electric light was the first used for light-house purposes. The light is of the first order, sixteen-sided, dioptric, holophotal revolving white light, of the system of Fresnell, showing a flash of eight seconds in every minute, and having a range of 25 miles seaward. It is, however discernible for a considerably greater distance, owing to the luminosity produced in the atmosphere by the electric beam before the direct rays become visible. It was constructed by Chance Brothers & Co., of Birmingham, England, under the supervision of Mr. Jas. N. Douglas, engineer to the Trinity Board, London. From that gentleman's report of his final inspection of the apparatus, together with a descriptive account by Dr. Hopkinson, one of the partners of the above firm, the following extracts are taken:

After explaining that the work had been much prolonged beyond the intended date, owing to unavoidable difficulties and delays which had occurred in the casting of the various parts of the novel and special optical apparatus, Mr. Douglas goes on to state that "the whole work has been completed, both as regards material and workmanship, perfectly. I can confidently state that the Macquarie light is at the present moment the most efficient in the world." Also, that he had "invented an improvement in oil and gas burners, by which a greater condensation of the focal light is effected than hitherto," which he had "placed at the disposal of Messrs. Chance Brothers for the Macquarie light, free of royalty, and consequently the gas and oil burners for use during clear weather have, with flames of 1½ in. diameter, an intensity of about 200 candles instead of 80 candles with the same diameter, as with the old type of burner originally intended. When these flames are at the focus, there is a consumption with the 16-candle gas of about 40 cu. ft. per hour, and with good paraffin of about one pint per hour, and I estimate the mean intensity of the flashes from the apparatus at about 40,000 candles, or about five times the intensity of the flashes of the existing Macquarie light. With full power of the electric light at the focus, the mean intensity of the flashes in the direction of the sea horizon is not less than five or six millions of candles. By a simple arrangement the change from gas light to electric light at the focus, or the reverse, can be effected in ten seconds, and the flames of the oil lamp can be substituted for the gas or electric light in nearly the same space of time."

The Macquarie light-house is intended only to illumine half the horizon; it is therefore possible to make use of the landward rays by means of a dioptric mirror. This was probably the first instance of the use of a dioptric mirror for an electric light. Special adjustment was needed to attain the result in a satisfactory manner. The whole apparatus is carried on a round pedestal, which offers the great advantage of enabling the keeper to enter without interfering with the rotation of the apparatus. Arrangements are made to burn either gas or paraffin oil, or to exhibit the electric light at full power or half power. When the electric light is in use there is always a second lamp in readiness for action. The practical result of the light-house has been to make the entrance to Sydney harbor perfectly safe, except during the most violent weather.

Judge E. H. Gary, E. C. Converse, William Edenborn, Percival Roberts and D. G. Reid, members of the executive committee of the United States Steel Corporation, and Sir Edward Windsor-Richard and Arthur Keen of the English iron and steel firm of Quest, Keen & Co., Ltd., are on a tour of inspection of the properties of the great steel corporation. It is understood that the party will spend considerable time in the Lake Superior mining region.

A Chicago correspondent says that the Weaver Coal Co., Marquette building, is preparing to push lake business in Maryland smokeless coal. This grade of coal is said to have no superiors and few equal as a steam fuel. The analysis announced for it is: Moisture, .989; non-combustible volatile matter, .706; combustible volatile, 14.204; fixed carbon, 76.451; ash, 7.650; total, 100. The portion of sulphur is .630.

The Power Publishing Co., New York, has issued a book entitled "Central Station Experiences," which is the series of narratives on the trials and tribulations of a steam engineer while learning to run an electric station that originally appeared in Power.

A particularly useful pump for boiler inspectors, marine engineers and boat owners generally, is that which is made by the Marine Iron Works, station A, Chicago, as illustrated on page 41 of their 1901 catalogue, which is sent free on receipt of request. 7

FOR SALE.

A new 125 H.P. Roberts high-pressure marine boiler, at a bargain. Immediate delivery. Write for particulars. James Beggs & Co., 9 Dey street, New York City. June 13.

BURNISHINE.

THE MOST MARVELOUS METAL POLISH IN THE WORLD.

In Liquid and Paste Form.

Will Polish Hot or Cold Metal, no matter which.

Produces a wonderfully brilliant lustre on brass, copper, nickel and all metals, no labor required.

Used on steamers all over the world. Free samples on application.

J. C. PAUL & CO.
57 Dearborn St., CHICAGO, ILL.

Worth is Proven by Use.

Words have not demonstrated the superiority of

Garlock Packings

over other makes. It has been done by their successful use on hundreds of thousands of engines and pumps, and for every known purpose on land and sea. This is the

VERDICT OF ENGINEERS

in all sections of the world, who have used GARLOCK PACKINGS.

Send for catalogue and samples to our nearest office.

THE GARLOCK PACKING CO.

NONE GENUINE

WITHOUT IT.

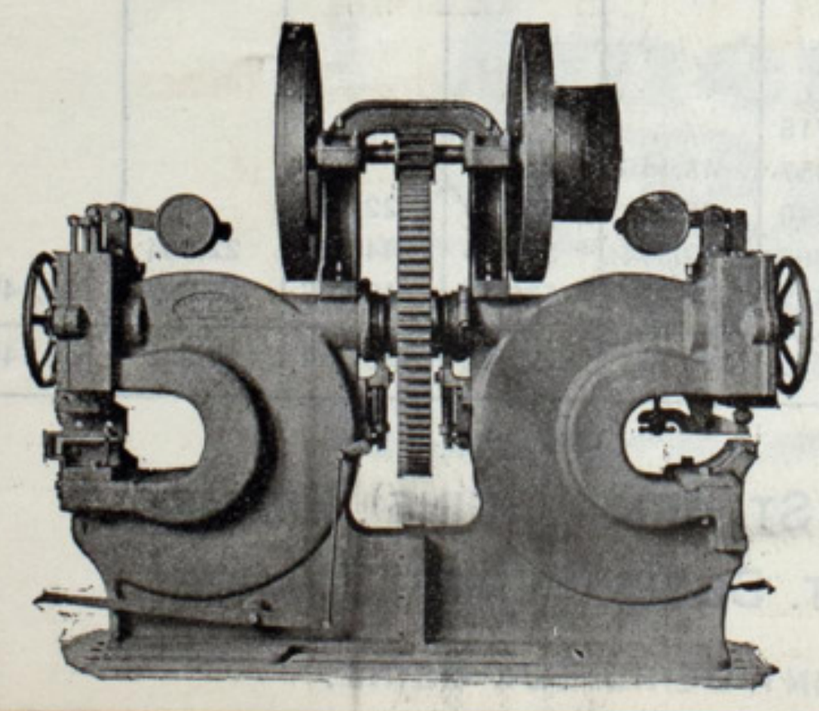
New York. Philadelphia. St. Louis.
Boston. Pittsburg. Denver.
Chicago. Cleveland. San Francisco.

MAIN OFFICES AND FACTORIES:
PALMYRA, N. Y.; ROME, GA.

"BENEDICT-NICKEL" SEAMLESS TUBING
FOR CONDENSER TUBES

Contains NO ZINC nor any weakening metal.
Send for Booklet with treatise on "Electrolysis of Condenser Tubes."

Benedict & Burnham Mfg. Co., *Mills and Offices.* Waterbury Conn.
New York, 253 Bd'wy. Boston, 172 High St.



THE CLEVELAND
Double End Punch and Shear.

A very handy tool in a ship building plant or any shop where considerable punching and shearing is done.

BUILT IN ALL SIZES AND CAPACITIES.

The Cleveland Punch and Shear Works Co.,
CLEVELAND, O., U. S. A.

AIR PUMPS,
all sizes and all kinds.

Also, WHISTLES, TANKS, Etc.

MANUFACTURED BY

The Gleason-Peters Air Pump Co.

20 W. Houston St., NEW YORK, U. S A.

"Seaboard Steel Castings."

MANUFACTURERS OF
"THE ADMIRAL" ANCHOR.

THE LATEST AND EEST STOCKLESS ANCHOR.
APPROVED BY LLOYD'S.

ANCHORS CAST AND TESTED ON ORDER, OR STOCK ORDERS PROMPTLY FILLED.

A GUARANTEE OF QUALITY.

OPEN-HEARTH STEEL CASTINGS OF THE HIGHEST GRADE.
FACILITIES FOR CASTINGS UP TO 80,000 POUNDS WEIGHT.
MACHINE WORK AND PATTERNS FURNISHED WHEN REQUIRED.
RAIL OR WATER DELIVERIES.
CAPACITY, 1500 TONS PER MONTH

Seaboard Steel Casting Co.,

CHESTER, PA.

Sealed proposals will be received at the office of the Light-House Engineer, Milwaukee, Wis., until 3 o'clock p. m., July 10, 1901, and then opened, for furnishing the materials and labor necessary for the construction of the steel steam light-house tender Hyacinth, in accordance with specifications, copies of which, with blank proposals and other information may be had upon application to Captain J. G. Warren, Corps of Engineers, U. S. A., Engineer. June 13.

FOR SALE.

BALANCED COMPOUND MARINE ENGINES carried in stock for immediate delivery—20 to 200 horse power. Full line of patterns for larger sizes and quadruple expansion engines, insuring quick delivery. Highest economy and speed.

NO VIBRATION. Contracts taken for complete plants.

July 25. **WELLS ENGINEERING CO., 136 Liberty St., NEW YORK, N. Y.**

WANTED.

Great Lakes Towing Co. stock. State price and number of shares. Address Manhattan, care the Marine Review Pub. Co., Perry-Payne building, Cleveland, O. June 6

TUG MAURICE W. FOR SALE.

Practically a new boat; 50 ft. over all, 12 ft. beam, 5 ft. draught. Swings a 4-ft. wheel. Machinery built by Sutton Bros. Price, $1,600, cash. L. E. Welch, Mackinaw City, Mich. June 13.

A New Locomotive Fire-Box Marine Boiler

For sale for immediate shipment. Shell 66 in. diameter. Fire box 84½ in. long, 89 in. high, 64 in. wide. Contains 237 2¼ in. by 17 ft. iron tubes. Steam drum 36 in. diameter, 11 ft. long. Working pressure, 200 lbs. Built to pass government inspection. Detailed specifications on application. The S. Freeman & Sons Mfg. Co., Racine, Wis. tf

STANDARD SEAMLESS TUBE CO.

MANUFACTURERS OF

Seamless Cold Drawn Steel Tubing

IN ALL SIZES FROM ⅛ TO 16" DIAMETER.

Stay Tubes,
Water Grates,
Compressed Air and
High Steam Pressures.

Boiler Tubes
FOR ALL CLASSES OF MARINE WORK.

Hollow Shafts,
Bushings,
Hydraulic Tubes,
Etc., Etc.

NATIONAL TUBE COMPANY,

SELLING AGENTS,

SALES OFFICES:

Havemeyer Building, New York.
Conestoga Building, Pittsburg.
Western Union Building, Chicago.
95 Milk St., Boston.
267 So. Fourth St., Philadelphia.
420 California St., San Francisco.

FOREIGN OFFICE:
Dock House, Billiter Street,
London, E. C., Eng.

Dearborn Vegetable Boiler Compounds.

SCIENTIFICALLY AND UNIFORMLY MADE. EVER RELIABLE.

Most Scientifically equipped, Complete, Handsome and expensively Furnished Laboratories, and the ONLY EXCLUSIVE LABORATORIES ON STEAM ECONOMY in the Country.

MARINE FORMULA NO. 5, For the WATERS of the FIVE LAKES.

To prevent pitti ıg, neutralize the oil, stop incrustation, and as a perfect preservative to the iron, boiler, and all its connections—especially prepared for the marine trade of the lakes.

If you are using a different water, prepay the express on a gallon jug of your feed water to the DEARBORN LABORATORIES at CHICAGO and receive a copy of analysis of same, with a written diagnosis of your case, and a letter giving you all the valuable information we can, and the actual cost of what it will require to clean your boilers and keep them clean. All of this will be done free of charge, and optional with you whether you order or not. When in Chicago call and inspect our Laboratories.

Analyzers of Everything.

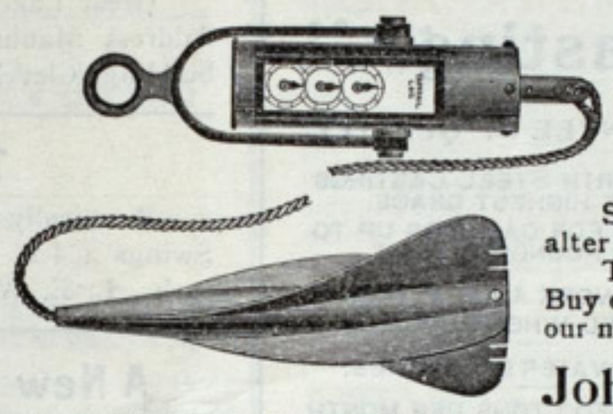
WM. H. EDGAR, President.

Makers of Boiler Compounds. DEARBORN DRUG & CHEMICAL WORKS Manufacturing and Analytical Chemists.

CHICAGO

OFFICES: 29, 30, 31, 32 and 33 Rialto Building. Telephone, Harrison, 1373. WORKS: 23, 25, 27 and 29 La Salle Street. Telephone No. 1130 South.

The BLISS TAFFRAIL LOG



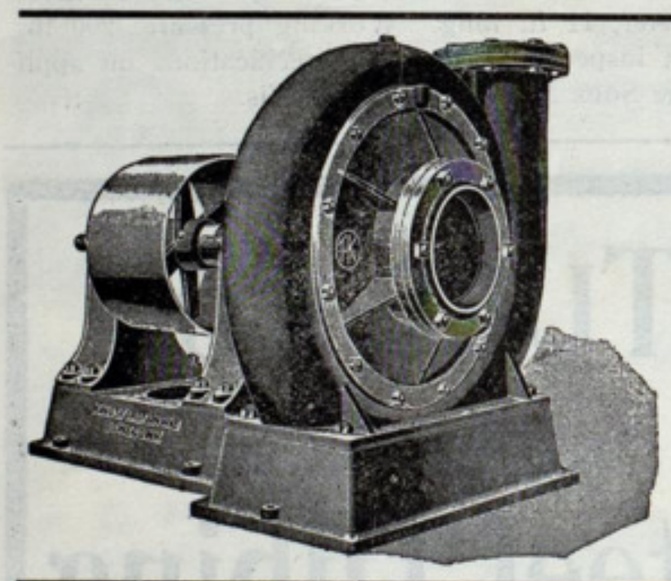
Over 11,000 Sold

A portion are now made to indicate Statute Miles for use on the Lakes.

Send us your old Bliss Register, and we will alter it to indicate statute miles for $3.50.

There are poorly made imitations of our rotator. Buy only the Bliss Adjustable Rotator, stamped with our name and patents. For sale by Ship Chandlers.

John Bliss & Co., 128 Front Street, NEW YORK.



DREDGING, WRECKING, CIRCULATING AND BALLAST PUMPS.

Marine Boilers.

KINGSFORD FOUNDRY AND MACHINE WORKS,

OSWEGO, N. Y.

ALL MATERIAL MANUFACTURED FROM OUR OWN IRON

WE HAVE OUR OWN GALVANIZING PLANT

NEWHALL CHAIN FORGE AND IRON CO.

OFFICES, HAVEMEYER BUILDING 26 CORTLANDT STREET NEW YORK

"WARWICK" SHIP DRIVING IRON, SPECIAL HEAD MACHINE AND HAND MADE SHIP SPIKES, CLINCH RINGS, SCREW BOLTS, RODS, TURNBUCKLES, PLAIN AND BABBITTED CHOCKS AND CLEATS,

DAVITS, SHACKLES, SWIVELS AND OTHER FORGINGS. CLOSE LINK AND STUD LINK YACHT AND SHIP CABLES, ANCHORS, BLOCKS, BUNKER PLATES, CAPSTANS, WINDLASSES & PUMPS.

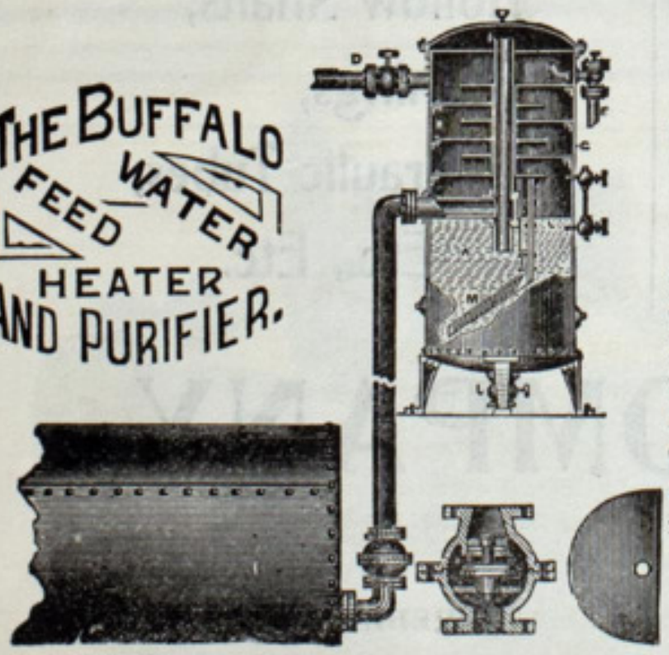
KEEP YOUR BOILERS CLEAN BY USING Clean Water

The "BUFFALO" is Warranted to Remove all Sediment and Scale Forming Substance.

Anyone Can Operate It.

IT ADDS YEARS TO THE LIFE OF THE BOILER.

THE BUFFALO FEED WATER HEATER AND PURIFIER.



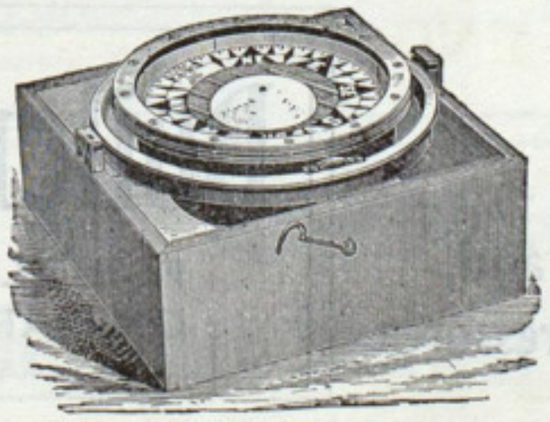
Used on principal steamers of Anchor Line, Lake Michigan & Lake Superior Transportation Co., American Steel & Wire Co., Bessemer Steamship Co., and others, aggregating 55,560 I. H. P.

Ask For Catalogue.

ROBERT LEARMONTH, Patentee,

100 WHITE BUILDING. BUFFALO, N. Y.

Ritchie Liquid Compass



THE STANDARD LIQUID COMPASS.

USED EXCLUSIVELY BY THE UNITED STATES NAVY FOR OVER 35 YEARS.

OVER 25,000 USED IN MERCHANT SERVICE.

Made in all sizes and styles, from 2 to 12 inches diameter of card. All compasses made by us have our name printed below the North point, or prominently upon the card. NONE OTHER ARE GENUINE. Latest form with four or six needles, the best instrument for iron ships. For sale by ship chandlers and nautical instrument dealers.

CATALOGUE FREE.

E. S. RITCHIE & SONS,

Manufacturers of Nautical and Physical Apparatus,

BROOKLINE MASS. U. S. A.

Absolute extinction of fires in holds or bunkers of ships no matter what the cargo.

Machine installed weighs 3800 lbs.

THE CLAYTON FIRE EXTINGUISHING AND DISINFECTING COMPANY,
11 BROADWAY, NEW YORK.

C&B LINE

Pan-American Route

between **CLEVELAND** and **BUFFALO.**

STEAMERS CITY OF BUFFALO AND CITY OF ERIE.

Finest and fastest passenger steamers in the United States.

TIME CARD—DAILY—APRIL 15 TO DEC. 1.

Leave Cleveland 8 p. m. Arrive Buffalo 6.30 a. m.
Leave Buffalo 8 p. m. Arrive Cleveland 6.30 a. m.

ADDITIONAL SERVICE DURING JULY AND AUGUST.

Connections made at Buffalo with trains for all Eastern and Canadian points; at Cleveland for Detroit and all points West and Southwest.

SPECIAL LOW RATES CLEVELAND TO BUFFALO AND NIAGARA FALLS EVERY SATURDAY NIGHT, ALSO BUFFALO TO CLEVELAND.

W. F. HERMAN, General Passenger Agent, Cleveland, O.

ONE OF THESE BINDERS

that will hold 52 NUMBERS of the

MARINE REVIEW,

Will be mailed to any address or receipt of $1.

MARINE REVIEW...
Perry-Payne Bldg.
CLEVELAND, O.

GEORGE STRATFORD OAKUM CO.,

MANUFACTURERS OF

Oakum, Plumbers' Spun and Marine Oakum and Spun Cotton.

OFFICE AND FACTORY:
CORNELISON AVENUE, JERSEY CITY, N. J.

Pintsch Gas Lighted Buoys

Adopted by the English, German, French, Russian, Italian, and United States Light House Departments, for Channel and Harbor Lighting; over 1000 gas buoys and gas beacons in service.

Burn Continuously

from 80 to 365 days and nights without attention, and can be seen a distance of six miles.

Brilliant and Steady Illumination.
Economical and Reliable in Operation.

Controlled by the **SAFETY CAR HEATING AND LIGHTING CO.,**
160 Broadway, New York City.

HIGH CLASS STEAM YACHTS, MARINE ENGINES,

Seabury's Water Tube Boilers,

AND

THE ONLY

NAPHTHA LAUNCH,

GAS ENGINE & POWER CO.

AND

CHARLES L. SEABURY & CO.,
Consolidated,
MORRIS HEIGHTS, NEW YORK CITY

Send 10c. stamp for catalogue.

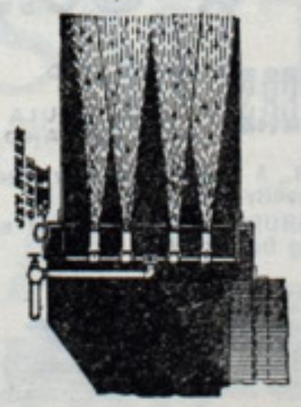
FOGG'S RESILIENT FELT MATTRESSES AND CUSHIONS

MANUFACTURED BY

M. W. FOGG,
20 Fulton St., NEW YORK.
Send for Illustrated Catalogue.

The Improved Annular Steam Jet.

FOR INDUCED DRAFT.

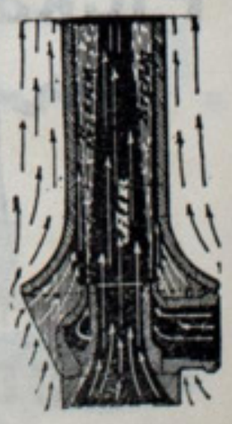


POWERFUL. ECONOMICAL.
15 to 25% increase in power.

Cut on right shows section of Jet Castings which are attached to spider in stack, as shown in cut on left.

REQUIRES NO ATTENTION.
ALWAYS READY FOR USE.

67 JETS IN USE.



H. BLOOMSBURG & CO.,
112 35th St., Newport News, Va.

OHIO FUEL COMPANY.

WE FURNISH ONLY THE BEST GRADE OF

PITTSBURG and GOSHEN **STEAM COAL.**

LIGHTER OF 300 TONS CAPACITY.

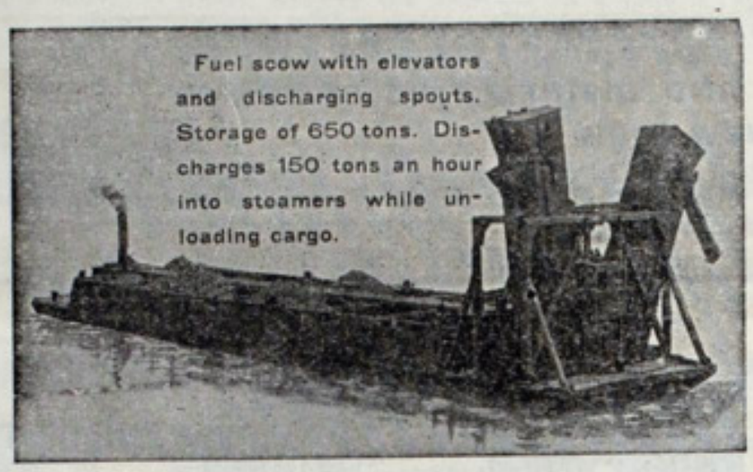
Dock Phone, Bell West 841.
Office Phones: { Bell Main 526. / Cuyahoga C 240.

219 The Cuyahoga Building, CLEVELAND, O.

Steamboat Fuel at Ashtabula.

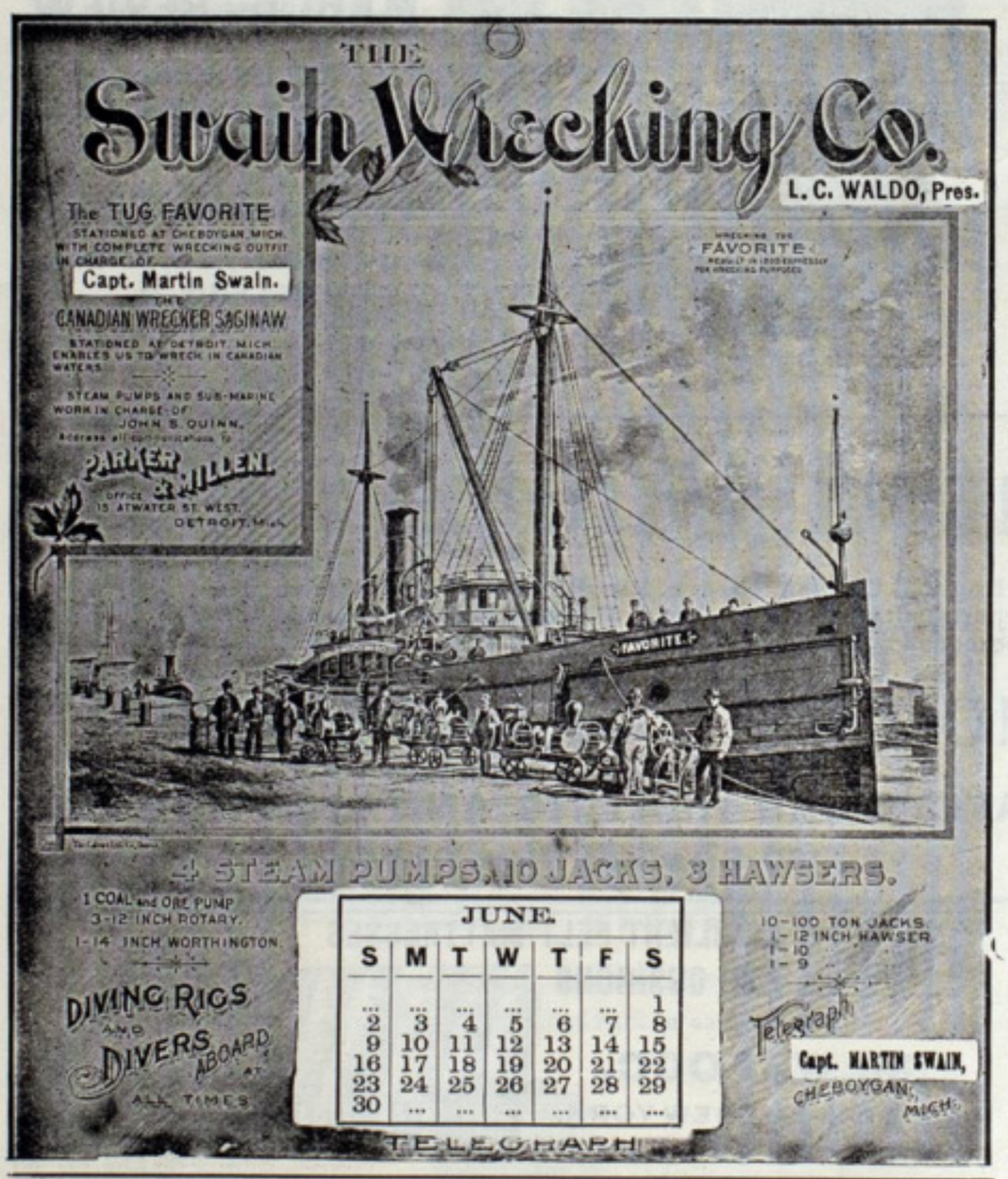
LARGE SUPPLIES OF BEST QUALITY

Lighter Carrying Different Grades at all Times.



M. A. HANNA & CO., Miners and Shippers. Main Office, Perry-Payne Bldg., Cleveland

THE **Swain Wrecking Co.** L. C. WALDO, Pres.



A. A. & B. W. PARKER, SUCCESSORS TO PARKER & MILLEN, DETROIT, MICH.

Pickands, Mather & Co.,

FUEL LIGHTERS AT BUFFALO, ERIE, ASHTABULA AND CLEVELAND.

AT DETOUR, MICH., A FUEL DOCK equipped with Shute capacity of 600 Tons.

Best Quality PITTSBURGH COAL furnished at any time during Day or Night.

Western Reserve Building, CLEVELAND, O.

Sterling, Welch & Co.

IMPORTERS, WHOLESALE AND RETAIL DEALERS IN

Carpets, Curtains and Upholstery Goods

OF EVERY DESCRIPTION.

An extensive assortment of the Newest and Choicest Styles of the best foreign and home manufacture, and for sale at the lowest market prices.

SPECIAL CONTRACTS MADE IN FURNISHING Boats, Yachts, Etc.

An inspection of our establishment and stock is earnestly solicited.

12 and 14 Euclid Avenue, CLEVELAND, O.

The Williams & Rodgers Company,

Superior and Seneca Sts., CLEVELAND, O.

WE MAKE A SPECIALTY OF FITTING OUT BOATS

Carpets, Rugs, Furniture, Curtains, Bedding,

AND ALL OTHER FURNISHINGS USED IN CABINS.

SPECIAL RATES TO THE MARINE TRADE.

Bring your Boat wants and your family wants to this store, and we'll take the very best care of you. Dry Goods, Housefurnishings, Carpets, Furniture, and all other articles found in a first-class Dry Goods House.

THE WILLIAMS & RODGERS COMPANY,

CLEVELAND, O.

The Erie & Western Transportation Co. ANCHOR LINE. 1901.

Passenger Service—

Steamers.....India, China, Japan.

Ports of call... Buffalo, Detroit, Erie, Sault Ste. Marie, Mackinac Island, Hancock, Port Huron, Marquette, Duluth, Cleveland, Houghton.

Freight Service—

Steamers.....Alaska, Schuylkill, Delaware, Lycoming, Conemaugh, Codorus, Conestoga, Juniata, Mahoning, Clarion, Lehigh, Susquehanna, Wissahickon.

Ports of call... Buffalo, Detroit, Houghton, Erie, W. Superior, Sault Ste. Marie, Cleveland, Hancock, Chicago, Marquette, Duluth, Milwaukee.

CHAS. E. MARKHAN, Gen. Pass. Agt., Buffalo, N. Y.

E. T. EVANS, Western Manager, Buffalo, N. Y.

THE DONNELLY SALVAGE AND WRECKING CO., Ltd

JOHN DONNELLY, SR., Pres.
JOHN DONNELLY, JR., Vice-Pres.
H. B. FOLGER, Treas.
THOS. DONNELLY, Secy.

KINGSTON ONT.

Divers, Steam Pumps, Tugs, Etc

SUPPLIED ON SHORTEST NOTICE.

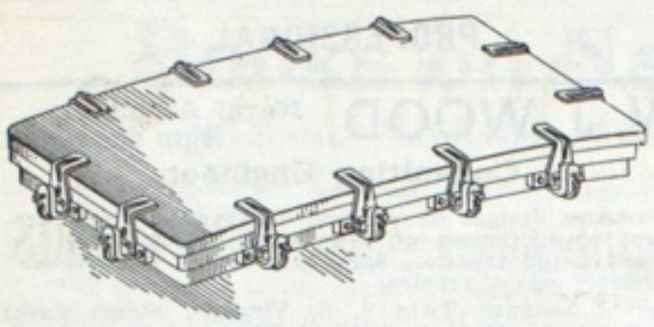
The W. L. SCOTT COMPANY, ERIE, PA.

WHOLESALE DEALER IN

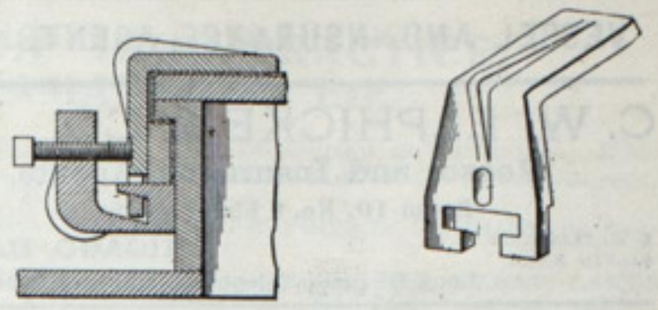
SHAMOKIN ANTHRACITE WILKESBARRE **COALS** YOUGHIOGHENY PITTSBURG MANSFIELD

VESSEL FUELING A SPECIALTY By STEAM LIGHTER or Car Dump at all hours. Electric Light.

Main Office, Scott Block, Long Distance Telephone No. 440.
Fueling Office, Canal Dock, Long Distance Telephone No. 320.



A Successful Hatch Fastener.



Costs Less than appliances now in use.
May be applied to any vessel by an ordinary workman.

Not only holds down the hatch cover, but at the same time battens the tarpaulin so securely as to insure the cargo against damage of any kind. May be applied equally well to wood or steel vessels and made in sizes to suit any hatch. Parts are all of malleable iron ; no danger of breakage ; not affected by heat or cold.

CAPT. M. MULHOLLAND, PATENTEE,
Wade Building, CLEVELAND, OHIO.

CASTNER, CURRAN & BULLITT,

SOLE AGENTS FOR

POCAHONTAS SMOKELESS SEMI-BITUMINOUS COAL

THE BEST STEAM COAL IN THE WORLD.

Officially endorsed by Great Britain and United States. Standard Fuel of United States Navy.
Used exclusively on Cunard, White Star and other Transatlantic Lines.

Main Office, 328 Chestnut Street - - PHILADELPHIA PA.

BRANCH OFFICES:

1 Broadway, New York.
Citizens Bank Building, Norfolk, Va.
Calle Reconquista 399, Buenos Ayres, Argentine Republic, South America.
Old Colony Building, Chicago, Ills.
70 Kilby Street, Boston, Mass.
Terry Building, Roanoke, Virginia.
Neave Building, Cincinnati, Ohio.
4 Fenchurch Avenue, London, England.

PITTSBURG COAL CO.

Steamboat Fueling Facilities at various points on the Great Lakes:

Cleveland Harbor	4 Car Dumpers. 3 Lighters.	Fairport Harbor	1 Car Dumper. 1 Lighter.	Ashtabula Harbor	1 Car Dumper. 1 Lighter.	Erie Harbor	1 Car Dumper. Fuel Pockets.

Detroit River Branch	Docks and Pockets at Sandwich and Amherstburg.	Sault River Branches	Dock and Pockets at Detour. Dock and Pockets at Sault Ste. Marie. (The Port Royal Dock Co.)

WE FURNISH ONLY THE BEST GRADE OF PITTSBURG and YOUGHIOGHENY COAL.

General Office, Lake Department, Perry-Payne Building, Cleveland, O.

STEAMBOAT FUEL AT CHICAGO.

THE Y&L

Youghiogheny and Lehigh Coal Co.

J. T. CONNERY, Manager. ARCHIE J. HITCHCOCK, Dock Sup't.

FUEL DOCKS:
No. 1, Michigan Slip & Basin. 'Phone Main 1650.
No. 2, N. Halsted St. Bridge. 'Phone Main 1649.
No. 3, Foot South Water St. and Illinois Central Slip C. 'Phone Main 1679.

FUEL LIGHTER: Equipped with 125 2-ton Buckets for Fueling Anywhere in Harbor.

MAIN OFFICE: 1238-1242 Chicago Stock Exchange Building.
Long Distance Telephone, Main 1650. 110 LA SALLE STREET.

The Rochester & Pittsburgh Coal & Iron Co.

REYNOLDSVILLE COAL.

STEAMBOAT FUEL DOCK—Blackwell Canal at Michigan St. Bridge. 1400 feet of dock frontage. Hulett Car Dumping Machine. Steam Fuel Scow of 550 tons capacity. Boats coaled day or night.

OFFICE: 684-88 Ellicott Square, BUFFALO, N. Y.
TELEPHONE, Seneca 1154.

E. McQ. DUTHIE,
Cargo and Fuel Agent.

STANLEY B. SMITH & CO.

DETROIT, MICH.

SHIPPERS OF **COAL** BY RAIL AND LAKE

OPERATING

SMITH'S COAL DOCK, Detroit River.

VESSEL AND INSURANCE AGENTS.

C. W. ELPHICKE & CO.
Vessel and Insurance Agents,
Room 10, No. 6 Sherman St.,
C. W. ELPHICKE.
CALVIN KARR.
CHICAGO, ILL.
Long Distance Telephone, Harrison 1194.

MITCHELL & CO.
JOHN MITCHELL.
JOHN F. WEDOW.
ALFRED MITCHELL.
Vessel and Insurance Agents,
508, 509 & 510 Perry-Payne Bldg.
Office Telephone M 767.
Residence, John Mitchell, Doan 341. CLEVELAND, O.
John F. Wedow, Doan 141 J. Alfred Mitchell, Doan 218.

F. H. OSBORN & CO.
Marine Insurance Brokers,
12 Sherman Street,
Long Distance Telephone, Harrison 1586. CHICAGO.

D. T. HELM & CO.
Vessel Agents,
TRANSPORTATION.
MARINE INSURANCE.
Board of Trade,
DULUTH, MINN.

W. C. RICHARDSON,
Vessel and Marine Insurance Agent,
420-421 Perry-Payne Building,
Office Telephone 338.
Residence Telephone 2938. CLEVELAND, O.

D. SULLIVAN & CO.
D. SULLIVAN.
F. J. SULLIVAN
VESSEL AGENTS.
MARINE INSURANCE.
2 & 4 Sherman Street, CHICAGO, ILL.
Tel. Harrison 2847.

J. G. KEITH & CO.
Vessel and Insurance Agents,
138-139 Rialto Building,
Long Distance Telephone, Harrison, 1339. CHICAGO.

S. R CHAMBERLAIN & CO.
Vessel and Insurance Agents,
No. 6 Sherman Street, CHICAGO.

HALL & ROOT,
JOHN B. HALL.
HARRY B. ROOT.
Vessel Agents,
21-22 Exchange Building, 202 Main St.,
Telephone Seneca 892. BUFFALO, N. Y.

DRAKE & MAYTHAM,
Vessel Agents,
M. M. DRAKE.
G. W. MAYTHAM.
202 Main Street,
Telephone Seneca 1660. BUFFALO, N. Y.

HUTCHINSON & CO.
Vessel and Insurance Agents,
Office Telephone, Main 2453.
Residence C. L. Hutchinson, W. 697L.
Residence W. H. McGean, E. 198J.
313-315 Perry-Payne Bldg.,
J. L. HUTCHINSON.
W. H. M'GEAN. CLEVELAND, O.

JOHN J. BOLAND,
Vessel and Insurance Agent,
25-26 Exchange Bldg., 202 Main St.,
Telephone Seneca 115. BUFFALO, N. Y

Nautical Encyclopedia
BY HOWARD PATTERSON.
Most complete work of its kind ever issued. In press. Price $3.00. Published by the Marine Review Pub. Co., Cleveland, O.

VESSEL AND INSURANCE AGENTS.

SAMUEL HOLMES,
Steamship Offices,
Morris Building,
For Selling, Chartering and Building all classes Steam Vessels.
66-68 Broad St.,
Steam Vessel Circulars.
Weekly Freight Circulars. NEW YORK.

WILSON TRANSIT CO.
General Forwarders,
Perry-Payne Bldg. CLEVELAND, O

BROWN & CO.
J. J. H. BROWN.
J. B. RODGERS.
EDWARD SMITH.
Vessel and Insurance Agents,
202 Main Street,
BUFFALO, N. Y.

PROCTORS IN ADMIRALTY.

RAY G. MacDONALD,
Attorney at Law and Proctor in Admiralty,
Suite 618 New York Life Building,
Telephone Central 723. CHICAGO, ILL.

STOWE & GRAYDON,
Lawyers and Proctors in Admiralty,
WILLIAM E. STOWE.
THOMAS J. GRAYDON.
204 Dearborn Street,
Suite 806 Marquette Building.
Telephone Central 1225. CHICAGO

HOYT, DUSTIN & KELLEY,
Lawyers and Proctors in Admiralty,
Offices, 702 Western Reserve Building,
CLEVELAND, O.

White, Johnson, McCaslin & Cannon,
ATTORNEYS AT LAW and PROCTORS IN ADMIRALTY,
Williamson Building, CLEVELAND, O.

GOULDER, HOLDING & MASTEN,
LAW OFFICES,
HARVEY D. GOULDER.
S. H. HOLDING.
FRANK S. MASTEN.
Perry-Payne Building,
CLEVELAND, O.

ALBERT J. GILCHRIST,
PROCTOR IN ADMIRALTY,
604 Perry-Payne Building,
CLEVELAND, O.

ORESTES C. PINNEY,
Lawyer and Proctor in Admiralty,
Rooms 316 and 317 Perry-Payne Building,
Telephone Main 2585. CLEVELAND, O.

"Elements of Navigation" (Henderson)
Just the book for beginners—mates, wheelmen and watchmen. Recommended because it is short, simple and yet comprehensive.
Price $1.
THE MARINE REVIEW PUB. CO., CLEVELAND.

PROFESSIONAL.

W. J. WOOD,
Naval Architect, Ship Surveyor.
Consulting Engineer.
Prepares designs or working drawings and specifications for all classes of vessels and superintends construction and repairs. Surveys damaged property and estimates cost of repairs.
Vessels designed—Twin S. S. Virginia, Steam Yacht Comanche, Twin S. S. North West and North Land, I. W. Nicholas, and many others, including Fire Boats, Tugs, Barges, etc.
COMPLETE PLANS FURNISHED FOR STEEL COMPOSITE OR WOODEN VESSELS
Office on Goodrich Dock, foot of Michigan Avenue, CHICAGO, ILL.

Pittsburgh Testing Laboratory, Ltd.,
INSPECTING AND METALLURGICAL ENGINEERS AND CHEMISTS,
1750 Monadnock, CHICAGO.
325 Water Street, PITTSBURGH.
906-7 Crozier Building, Philadelphia.
New York City, 60 New Street.
Richmond, Va., 1107½ Main Street.
Inspectors of Shipbuilding Materials and Machinery. Inspectors located at all mills, Physical and Chemical Laboratories. Tests of all kinds.

ROBERT W. HUNT & CO.
Bureau of Inspection, Tests and Consultation.
1121 The Rookery, Chicago.
Monong. Bank Bldg., Pittsburgh.
71 Broadway, New York.
Inspectors of Shipbuilding Material and Machinery. Inspectors of all Materials. Duty Tests of Engines and Boilers. Physical and Chemical Laboratories.

HORACE SEE,
CONSULTING ENGINEER AND NAVAL ARCHITECT,
No. 1 Broadway, NEW YORK

EDWARD GASKIN,
Ship Building Expert.
Plans and specifications for ships, surveys and estimates, superintendence, etc.
ELLICOTT SQUARE, BUFFALO, N. Y.

AMBROSE V. POWELL, M. Am. Soc. C. E.
CIVIL ENGINEER,
Designs and Constructs Dry Docks, Harbor Works, Docks and Plant for Handling Coal and Ore, Foundations.
Office, 1008 Chamber of Commerce, CHICAGO, ILL.

PATENTS.

THURSTON & BATES,
Counselors at Law in Patent Causes and Solicitors of Patents,
1028 Society for Savings Bldg.,
E. L. THURSTON.
ALBERT H. BATES. CLEVELAND, O.

HERBERT WRIGHT & CO.,
1011-1015
THE WILLIAMSON BUILDING,
CLEVELAND, O.
TELEPHONE, MAIN 2754.
Every possible facility for conducting a brokerage business in
STOCKS, BONDS, GRAIN, ETC.

Compass Adjuster
CAPT. J. M. FIELDS.
Inventor of Fields' Course Finder,
BETHEL HOTEL. CLEVELAND O

Books on Naval Architecture, SHIP YARD PRACTICE, SEAMANSHIP, Etc.

AMERICAN PRACTICAL NAVIGATOR—Nathaniel Bowditch. $2.25.

AZIMUTH TABLES for the Great Lakes—Hydrographic Office. 50 cents.

BOILER MAKERS AND IRON SHIP BUILDERS' COMPANION. Comprising a series of original and carefully calculated tables. James Foden. $2.

BOWDITCH'S USEFUL TABLES. $1.25.

CONSTRUCTION AND MAINTENANCE OF VESSELS BUILT OF STEEL—Thos. Walton. In preparation.

DATA BOOK—Naval architects and engineer's data book. By T. H. Watson. A reliable and simple means of recording valuable data, etc., of vessels and engines. Size of book, 8¾ in. by 5 in., cloth, $2.

ELEMENTARY NAVAL TACTICS—Com. Wm. Bainbridge-Hoff, U. S. N. $2.

ELEMENTARY SEAMANSHIP—D. Wilson Barker. $2.

ELEMENTS OF NAVIGATION—Henderson. $1.

GEORGIAN BAY AND NORTH CHANNEL PILOT—Department of Marine and Fisheries, Canada.

GEORGIAN BAY AND NORTH CHANNEL SAILING DIRECTIONS—Hydrographic Office. 40 cents.

HINTS ON LEGAL DUTIES OF SHIPMASTERS—B. W. Ginsburg. $1.75.

ILLUSTRATED NAUTICAL ENCYCLOPEDIA—Howard Patterson. In press. $3.

ILLUSTRATIVE CLOUD FORMS FOR THE GUIDANCE OF OBSERVERS IN THE CLASSIFICATION OF CLOUDS—Hydrographic Office. $1.00.

INTERNATIONAL SIGNAL CODE—Bureau of Navigation. $2.50.

KNOW YOUR OWN SHIP—Thos. Walton. $2.50.

LAKE SUPERIOR AND ST. MARY'S RIVER SAILING DIRECTIONS—Hydrographic Office. 30 cents.

LATITUDE AND LONGITUDE: How to Find Them—W. J. Millar. $1.

MANUAL OF ALGEBRA—R. C. Buck. For the use, more especially, of young sailors and officers in the merchant navy; numerous examples and exercises. $1.50.

MARINER'S COMPASS IN AN IRON SHIP: How to keep it efficient and use it intelligently. J. W. Dixon. $1.

MODEL ENGINES AND SMALL BOATS—N. M. Hopkins. New methods of engine and boiler making; ship design and construction; fifty illustrations. $1.25.

MODERN PRACTICE OF SHIP BUILDING IN IRON AND STEEL. Samuel J. P. Thearle. 2 volumes. Second edition, revised and enlarged. $5.25.

NAVAL ARCHITECTURE: A treatise on laying off and building wood, iron and composite ships. Samuel J. P. Thearle. In two volumes. $3.

NAVAL ARCHITECTURE: A manual on laying off iron and steel vessels—Thos. H. Watson. Valuable for naval architects as well as beginners in ship yards. $5.

NAVAL ARCHITECTURE—Sir W. H. White. New Edition. 750 pages. $9.

NAVAL ARCHITECTURE—J. J. Welch. New edition. Out soon.

NAVAL ARCHITECTS AND SHIPBUILDER'S POCKET BOOK—Clement Mackrow. Formulae, rules and tables, and marine engineers' and surveyors' Handy Book of Reference. Seventh edition. 700 pages; pocket-book form. $5.

NAVAL POCKETBOOK—Clowe. $2. Containing valuable information concerning all navies of the world.

NAVIGATION AND NAUTICAL ASTRONOMY—Prof. J. H. C. Coffin. $3.50.

NAVIGATION: THEORETICAL AND PRACTICAL—D. Wilson Barker. Illustrated. $1.50.

OCEAN METEOROLOGY: For vessels of the Merchant Navy—William Allingham. $2.

THE PILOT: A guide to United States Local Inspectors' examinations of Masters and Mates. R. M. Pugsley. $1.

POCKET BOOK OF MARINE ENGINEERING, RULES AND TABLES—Seaton and Rounthwaite. For marine engineers, naval architects, superintendents and others engaged in construction of marine machinery. $3.

PRACTICAL INFORMATION ON THE DEVIATION OF THE COMPASS, for the use of Masters and Mates of Iron Ships—J. T. Towson. $2.

PRACTICAL MARINE SURVEYING—Harry Phelps. $2.50.

PRACTICAL MECHANICS, Applied to the Requirements of the Sailor—Thos. Mackenzie. $1.50.

PRACTICAL NAVAL ARCHITECTURE—S. J. P. Thearle. Two vols., $3.

PRACTICAL SEAMANSHIP FOR USE IN THE MERCHANT SERVICE: Including all ordinary subjects; also Steam Seamanship, Wreck Lifting, Avoiding Collision, Wire Splicing, Displacement, and everything necessary to be known by seamen of the present day. Second edition, illustrated. John Todd and W. B. Whall. $8.40.

PROJECTION TABLES—Bureau of Navigation. $1.50.

RESISTANCE AND PROPULSION OF SHIPS—Durand. $5.

RESISTANCE AND PROPULSION OF SHIPS—By Taylor. $3.75.

SAILING DIRECTIONS FOR THE GREAT LAKES AND CONNECTING WATERS. Second edition. Hydrographic Office. 30 cents.

SCOTT'S COAST PILOT FOR THE GREAT LAKES. $1.50.

SCREW PROPELLERS AND MARINE PROPULSION—I. McKim Chase. $2.50.

SELF-INSTRUCTION IN THE PRACTICE AND THEORY OF NAVIGATION—Earl of Dunraven. Two volumes. $7.

SHIP BUILDING—Tables for constructing ship's lines. Second edition. Archibald Hogg. $2.

SIMPLE ELEMENTS OF NAVIGATION—Young. New second edition, $2; a few copies of the first edition at $1.

STABILITY OF SHIPS—Sir E. J. Reed. $8.40.

STEAM YACHTS AND LAUNCHES—By Kuhnhardt. $3.

STEERING OF SHIPS AND YACHTS AND MANEUVERING THEM IN NARROW WATERS; having especial reference to the influence of the Screw Propeller on the steering of steamers. Sir C. Purcell Taylor. $1.25.

ST. LAWRENCE RIVER SAILING DIRECTIONS. Second edition. Hydrographic Office. 70 cents.

SUBMARINE BOATS—By Hovguard. $2.

TABLES FOR FINDING THE DISTANCE OF AN OBJECT BY TWO BEARINGS—Hydrographic Office, U. S. N. 30 cents.

TEXT BOOK OF SEAMANSHIP—Com. S. B. Luce, U. S. N. Equipping and handling of vessels under sail or steam. $10.

THEORETICAL NAVAL ARCHITECTURE: A treatise on the calculations involved in naval design. Samuel J. P. Thearle. In two volumes. $3.50.

THEORETICAL NAVAL ARCHITECTURE—E. L. Attwood. Text book; 114 diagrams. $2.50.

TRIGONOMETRY FOR THE YOUNG SAILOR—R. C. Buck. $1.50.

"WRINKLES" IN PRACTICAL NAVIGATION. Ninth edition, revised. S. T. S. Lecky. $8.40.

Books on Marine Engineering, On the Operation of Engines and for Beginners in the Engine Room.

AIDS TO ENGINEERS' EXAMINATIONS, with Questions and Answers—N. Hawkins. $2.

ALGEBRA SELF-TAUGHT—W. P. Higgs. Fourth edition. 60 cents.

AMERICAN MARINE ENGINEER—By Edwards. $2.50.

ARITHMETIC OF THE STEAM ENGINE—E. S. Gould. $1.

BREAKDOWNS AT SEA AND HOW TO REPAIR THEM—A. R. Leask. 252 pages. $2.

BREAKDOWNS—Thos. Reed. $1.50.

CATECHISM OF THE MARINE STEAM ENGINE—Edwards. $2.

DATA BOOK—Valve setting record book, for the use of marine engineers, by P. A. Low. 60 cents.

DATA BOOK—The engineer's and draughtsman's data book, for workshop and office use. So arranged that the data of a complete set of engines, boilers, auxiliary engines, pumps, etc., for a steamship can be recorded on four pages. Enough space for 20 sets of engines. Bound in full limp leather. $1.25.

DATA BOOK—Marine engineer's record book—engines. By Bryan C. Bartley. Names of all parts, etc., are printed in one column on the left hand side of book when opened, and the remaining space is lined and column ruled for the recording of all necessary data. Complete thumb index which will facilitate ready reference. Contains enough space for 22 complete sets of engines. Size of book, 7¾x5¼ in., bound in full limp leather. $2.00.

DRAWING AND DESIGNING FOR MARINE ENGINEERS—Chas. W. Roberts. $3.

ELECTRIC LIGHTING FOR MARINE ENGINEERS, or how to light a ship by the electric light and how to keep the apparatus in order. S. F. Walker. $2.

ELECTRIC SHIP LIGHTING—A hand book on the practical fitting and running of ship's electrical plant. J. W. Urquhart. $3.

ELEMENTARY LESSONS IN STEAM MACHINERY—Langmaid and Galsford. For students and subordinates in marine engineering. $2.

ENGINEER'S MANUAL—By Ainsley. $5.

ENGINE ROOM PRACTICE—John Leveridge. $2.50.

ENGINES AND ENGINE RUNNING—Joshua Rose. For the use of those who desire to pass an examination to take charge of an engine or boiler; illustrated. $2.50.

EXAMINATION QUESTIONS AND ANSWERS—Emory Edwards. 900 examination questions and answers for young engineers and firemen who desire to obtain marine licenses. $1.50.

GAS AND OIL ENGINES—G. Richmond. A practical hand book on the care and management of gas engines, with instructions for running oil engines. $1.

HAND BOOK OF ENGINEERING PRACTICE—Richard A. Smart. $1.25.

HAWKINS' INDICATOR CATECHISM. $1.

HIGH SPEED STEAM ENGINES—W. Norris and Ben H. Morgan—With 115 Illustrations. $2.50.

HOW TO RUN ENGINES AND BOILERS. Practical instruction for young engineers and steam users. E. P. Watson. $1.

KEY TO ENGINEERING, WHAT AN ENGINEER SHOULD KNOW ABOUT ELECTRICITY and ENGINEER'S EPITOME—Three excellent little books for marine engineers. 50 cents each, or three for $1.

KEY TO ENGINES AND ENGINE RUNNING—Joshua Rose. For use of those desiring to pass examination to take charge of an engine or boiler. $2.50.

LESSONS AND PRACTICAL NOTES ON STEAM, THE STEAM ENGINE, PROPELLERS, ETC.—King. $2.

LIBRARY OF STEAM ENGINEERING—John Fehrenbatch, M. E. $5.

MACHINISTS' AND DRAFTMEN'S HAND BOOK—Peder Lobben. A reference book for all interested in mechanical work. $2.50.

MARINE BOILER MANAGEMENT AND CONSTRUCTION—C. E. Stromeyer. $5.

MARINE BOILERS: A treatise on the Causes and Prevention of their Priming, with remarks on their general management. Reed. $2.

MARINE BOILERS—L. E. Bertin. 250 illustrations, designs and tables. $7.50.

MARINE BOILERS—Triplex. $1.

MARINE ENGINEERS—Constantine. Just out. $2.50.

MARINE ENGINES AND STEAM VESSELS—By Murray. $1.60.

MARINE ENGINES—R. Murray. $1.80.

MARINE PROPELLERS—By Barnaby. $4.25.

MARINE STEAM ENGINES—Sennett & Oram. $6.

MARINE STEAM ENGINES—Main and Brown. $5.

MECHANICS' AND ENGINEERS' POCKET BOOK, including Naval Architecture, Steam and the Steam Engine, Steam Vessels, etc. 64th edition, 1050 pages. Chas. H. Haswell. $4.

MECHANICAL ENGINEERS' POCKET BOOK—Wm. Kent. Reference book of rules, tables, etc. $5.

MECHANISM OF MEN-OF-WAR—R. C. Oldknow. A description of machinery to be found in modern fighting ships. Numerous illustrations. $3.

MODERN EXAMINATIONS OF STEAM ENGINEERS—W. H. Wakeman. $1.50.

MODERN AMERICAN MARINE ENGINES—By Edwards. $5.

MODERN MARINE ENGINEERING—By Burgh. $10.

NAUTICAL ENCYCLOPEDIA, ILLUSTRATED—Howard Patterson. Complete from Standpoint of Marine Engineer and Naval Architect. In press. $3.

NAVAL ENGINEER AND THE COMMAND OF THE SEA—F. G. Burton. $1.25.

NEW CATECHISM OF ELECTRICITY—N. Hawkins. $2.

POCKET BOOK OF MARINE ENGINEERING, RULES AND TABLES—Seaton and Rounthwaite. For marine engineers, naval architects, superintendents and others engaged in construction of marine machinery. $3.

PRACTICAL ADVICE FOR MARINE ENGINEERS—C. W. Roberts. 64 illustrations. $1.

PROGRESS OF MARINE ENGINEERING—By Main. $1.50.

QUESTIONS AND ANSWERS, 188 Elementary, from Reed's Engineers' Hand Book. A valuable help to the young engineer working up for his license. $1.

QUESTIONS AND ANSWERS, sixth edition—Stephen Roper. $2.

REED'S ENGINEERS' HAND BOOK—New edition; illustrated by 345 diagrams and 36 large plates. $5.
REED'S GUIDE. $5.

REED'S KEY to Reed's Hand Book—Contains working of all questions given in examination papers. $3.

RESISTANCE AND PROPULSION OF SHIPS—W. F. Durand, principal of school of marine construction, Cornell University. $5.

ROPER'S ENGINEERS' HANDY BOOK for Steam Engineers and Electricians. Revised and enlarged. $3.50.

SCREW PROPULSION—By Taylor. $3.75.

SLIDE VALVE, SIMPLY EXPLAINED—W. J. Tennant. $1.

SLIDE VALVES—C. W. MacCord, Jr. A book for practical men on the principles and methods of design. $1.50.

SMALL ENGINES AND BOILERS—Egbert P. Watson. A manual of concise and specific directions for construction of small steam engines and boilers of modern types; illustrated. $1.25.

STEAM AND THE MARINE STEAM ENGINE—Jno. Yeo. $2.50.

STEAM BOILERS: Their management and working on land and sea. James Peattie. $2.

STEAM BOILERS—Joshua Rose. Practical treatise on construction and examination. Seventy-three engravings. $2.50.

STEAM BOILERS—Peabody & Miller. $2.50.

STEAM ENGINES AND BOILERS—Frederick Colyer. $5.

STEAMSHIPS AND THEIR MACHINERY—By Haldane. $6.

TEXT BOOK ON MARINE ENGINEERING—Tompkins. $3.00.

THEORETICAL AND PRACTICAL AMMONIA REFRIGERATION—I. I. Redwood. $1.

THEORY OF STEAM ENGINE—Weisbach. $5.

TRIPLE AND QUADRUPLE EXPANSION ENGINES AND BOILERS AND THEIR MANAGEMENT—A. Ritchie Leask. Third edition, revised. $2.

USEFUL HINTS TO SEAGOING ENGINEERS, AND HOW TO REPAIR AND AVOID BREAKDOWNS. Second edition, revised and enlarged. Reed. $1.40.

WATER TUBE BOILERS—Fourth revised and enlarged edition of HOW TO RUN ENGINES AND BOILERS—E. P. Watson. Practical instruction for young engineers and steam users. $1.

The Marine Review Publishing Co.,

Sent to any address, carriage prepaid, at prices named. **PERRY-PAYNE BUILDING, CLEVELAND.**

BUYERS' DIRECTORY OF THE MARINE TRADE.

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by the Marine Review Pub. Co., 418-419 Perry-Payne Bldg., Cleveland.

See accompanying Index of Advertisers for full addresses of concerns in this directory.

AIR COMPRESSORS, AIR HOISTS, ETC.

"Long Arm" System Co.....Cleveland.

AIR PUMPS AND APPLIANCES.

Gleason-Peters Air Pump Co.....New York.

ANCHORS.

Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.
Seaboard Steel Casting Co.....Chester, Pa.

ANTI-FRICTION METALS.

Cramp, Wm. & Sons.....Philadelphia.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.

American Blower Co.....Detroit.
American Ship Building Co.....Cleveland.
Bloomsburg & Co., H.....Newport News, Va.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

ATTORNEYS AND PROCTORS IN ADMIRALTY.

Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley.....Cleveland.
MacDonald, Ray G.....Chicago.
Pinney, Orestes C.....Cleveland.
Stowe & Graydon.....Chicago.
White, Johnson, McCaslin & Cannon.....Cleveland.

BAROMETERS, MARINE GLASSES, ETC.

Bliss, John & Co.....New York.
Goerz, C. P.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

BENDING AND STRAIGHTENING ROLLS.

Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

BLOCKS, SHEAVES, ETC.

Boston & Lockport Block Co.....Boston, Mass.
Cleveland Block Co.....Cleveland.
Coleman & Sons, Walter.....Providence, R. I.

BLOWERS.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

BOAT NAILS AND SPIKES.

American Steel & Wire Co.....Chicago.

BOAT BUILDERS.

Drein, Thos. & Son.....Wilmington, Del.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Kahnweiler's Sons, David.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

BOILER MANUFACTURERS.

Almy Water Tube Boiler Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Babcock & Wilcox Co.....New York.
Bath Iron Works, Ltd.....Bath, Me.
Boyer Water Tube Boiler Co.....New York.
Chicago Ship Building Co.....Chicago.
Cramp, Wm. & Sons.....Philadelphia.
Delaunay, Belleville & Co.....St. Denis, France.
Detroit Screw Works.....Detroit.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Gas Engine & Power Co.....Morris Heights, N. Y.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Kingsford Foundry & Machine Works.....Oswego, N. Y.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Building Co..Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roberts Safety Water Tube Boiler Co.....New York.
Stirling, The Co.....Chicago.
Trigg, Wm. R. Co.....Richmond, Va.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

BOILER COMPOUNDS.

Dearborn Drug & Chemical Works.....Chicago.

BOILER FURNACES, FIRE FRONTS, ETC.

Continental Iron Works.....New York.

BOILER RIVETS.

Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.

Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BOLT CUTTERS.

Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

BORING AND TURNING MILLS.

Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

BRASS AND BRONZE CASTINGS.

Cramp, Wm. & Sons.....Philadelphia.
Illinois Smelting & Refining Works.....Chicago.
Phosphor Bronze Smelting Co.....Philadelphia.

BRIDGES, BUILDERS OF.

American Bridge Co.....New York.
Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.

Brown Hoisting & Conveying Machine Co.....Cleveland.
McMyler Mnfg. Co.....Cleveland.

CABIN AND CABINET FINISHING WOODS.

Martin-Barriss Co.....Cleveland.

CAPSTANS.

American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

CHAINS.

Monongahela Iron & Steel Co.....Pittsburg.
Newhall Chain Forge & Iron Co.....New York.
Standard Chain Co.....Pittsburg.

CHAIN HOISTS.

Boston & Lockport Block Co.....Boston, Mass.

CHUCKING MACHINES.

Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

CHUCKS FOR LATHES, DRILLS AND PLANERS.

Skinner Chuck Co.....New Britain, Conn.

CIRCULATOR, EQUILIBRIUM, with Steam Heating Attachment.

Bloomsburg & Co., H.....Newport News, Va.

CLOCKS (Marine), CHRONOMETERS, BELLS.

Ashton Valve Co.....Boston.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.

Castner, Curran & Bullitt.....Philadelphia.
Hanna, M. A. & Co.....Cleveland.
Ohio Fuel Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Scott Co., The W. L.....Erie, Pa.

COAL AND ORE HANDLING MACHINERY.

Brown Hoisting Machinery Co., Incorporated..Cleveland.
Lidgerwood Mnfg. Co.....New York.

COMPASSES.

Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

COMPASS ADJUSTER.

Fields, J. M.....Cleveland.

CORK JACKETS AND RINGS.

Armstrong Cork Co.....Pittsburgh, Pa.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

CRANES, CONVEYORS, HOISTS.

Brown Hoisting Machinery Co., Incorporated..Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York.
Niles Tool Works Co.....Hamilton, O.
Westinghouse Electric & Mnfg. Co.....Pittsburg.
Wood & Co , R. D.....Philadelphia.

CRANK PINS.

Cleveland City Forge & Iron Co.....Cleveland.

DIVING APPARATUS.

Hale Rubber Co., Alfred.....So. Boston, Mass.

DOORS—PNEUMATIC AND ELECTRIC SAFETY POWER DOORS AND HATCHES.

"Long Arm" System Co.....Cleveland.

DRILL PRESSES—DRILLS OF ALL KINDS.

Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

DRYING APPARATUS.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Sturtevant, B. F. Co.....Boston.

DRILLS, PNEUMATIC.

Standard Pneumatic Tool Co.....Chicago.

DRY DOCKS.

American Ship Building Co.....Cleveland.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Harlan & Hollingsworth Co.....Wilmington, Del.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Shipowners Dry Dock Co.....Chicago.
Union Iron Works.....San Francisco.

ELECTRIC AUTOMATIC WHISTLE OPERATORS.

Signal & Control Co.....New York.

ELECTRIC LIGHT AND POWER PLANTS.

Buffalo Forge Co.....Buffalo.
Bullock Electric Mnfg. Co.....Cincinnati.
Electro-Dynamic Co.....Philadelphia.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Seidler-Miner Electric Co.....Detroit.
Sturtevant, B. F. Co.....Boston.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC HOISTS AND CRANES.

Bullock Electric Mnfg. Co.....Cincinnati.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC STEERING GEAR, SPEED AND RUDDER INDICATORS, ETC.

Electro-Dynamic Co.....Philadelphia.

ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lake Shore Engine Works.....Marquette, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Olds Motor Works.....Detroit.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
Electro-Dynamic Co.....Philadelphia.
Seidler-Miner Electric Co.....Detroit.

ENGINEERING SPECIALTIES AND SUPPLIES.

Crane & Co.....Chicago.
Reilly Repair & Supply Co., James.....New York.

ENGINEERS, MARINE AND MECHANICAL.

Electro-Dynamic Co.....Philadelphia.
Hunt, Robt. W. & Co.....Chicago.
Miller, Walter.....Cleveland.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.
Powell, Ambrose V.....Chicago.
See, Horace.....New York.
Wood, W. J.....Chicago.

EVAPORATING AND DISTILLING APPARATUS.

Reilly Repair & Supply Co., James.....New York.

FANS FOR VENTILATION, EXHAUST, ETC.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.
Reilly Repair & Supply Co., James.....New York.
Reynolds, H. J.....Cleveland.

FIRE EXTINGUISHING APPARATUS.

Clayton Fire Extinguishing & Disinfecting Co.New York.

FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

FORGES.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FORGINGS.

Bourne-Fuller Co.....Cleveland.
Cleveland City Forge & Iron Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

FUELING COMPANIES AND COAL DEALERS.
Castner, Curran & Bullitt (Pocahontas).....Philadelphia.
Hanna, M. A. & Co.....Cleveland.
Ohio Fuel Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Scott Co., The W. L.....Erie, Pa.
Smith, Stanley B. & Co.....Detroit.
Youghiogheny & Lehigh Coal Co.....Chicago.

GAS BUOYS.
Safety Car Heating & Lighting Co.....New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.
Lake Shore Engine Works.....Marquette, Mich.
Olds Motor Works.....Detroit.

GAGES, STEAM AND VACUUM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

GRAPHITE BUSHINGS AND BEARINGS.
Graphite Lubricating Co.....Bound Brook, N. J.

HAMMERS, PNEUMATIC.
Standard Pneumatic Tool Co.....Chicago.

HAMMERS, STEAM.
Bement, Miles & Co.....Philadelphia.
Chase Machine Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

HATCH FASTENERS.
Mulholland, M.....Cleveland.

HATCH GEARS.
"Long Arm" System Co.....Cleveland.

HAWSERS, WIRE.
American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co., Incorporated..Cleveland.
Chase Machine Co.....Cleveland.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
Marine Iron Co.....Bay City.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

HOSE FOR PNEUMATIC TOOLS.
Sayen & Schultz.....Philadelphia.

HYDRAULIC MACHINERY.
Bement, Miles & Co.....Philadelphia.
Watson-Stillman Co., The.....New York.
Wood & Co., R. D.....Philadelphia.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

IGNITERS FOR GAS ENGINES.
Holtzer-Cabot Electric Co.....Brookline, Mass.

INJECTORS.
Crane Co.....Chicago.
Jenkins Bros.....New York.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

LAUNCHES—NAPHTHA, ELECTRIC.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

LOGS.
Walker & Son, Thomas.....Birmingham, Eng.
Also Ship Chandlers.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MACHINE TOOLS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

MALLETS FOR CAULKERS, BOILER MAKERS, ETC.
N. Y. Mallet & Handle Works.....New York.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Blower Co.....Detroit.
American Ship Building Co.....Cleveland.
Boston Blower Co.....Hyde Park, Mass.
Bloomsburg & Co., H.....Newport News, Va.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.
Paul & Co., J. C.....Chicago.

MILLING MACHINES OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
See, Horace.....New York.
Wood, W. J.....Chicago.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

OUTFITTING OF VESSELS—CARPETS, FURNITURE, ETC.
Sterling, Welch & Co.....Cleveland.
Williams & Rodgers Co.....Cleveland.

PACKING.
Crane Co.....Chicago.
Garlock Packing Co.....Palmyra, N. Y.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
Sayen & Schultz.....Philadelphia.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Smith, Edward & Co.....New York.
Upson-Walton Co.....Cleveland.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PIPE THREADING AND CUTTING MACHINES.
Merrell Mnfg. Co.....Toledo, O.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.
Crane Co.....Chicago.

PLANERS OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PLATE BENDING AND PLANING MACHINES.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

PLUMBING, MARINE.
Mott Iron Works, J. L.....New York.
Reilly Repair & Supply Co., James.....New York.
Sands, Alfred B. & Son.....New York.

PNEUMATIC TOOLS.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.
Paul & Co., J. C.....Chicago.

PRESSURE REGULATORS.
D'Este Co., Julian.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.

PROJECTORS, ELECTRIC.
Bullock Electric Mnfg. Co.....Cincinnati.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Kingsford Foundry & Machine Works.....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER GOODS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SEAM COMPOSITION AND ELASTIC SEAM PAINT.
Cole & Kuhls.....Brooklyn.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Trigg, Wm. R. Co.....Richmond, Va.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Moran Bros. Co.....Seattle, Wash.
Reilly Repair & Supply Co., James.....New York.
Upson-Walton Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Cleveland & Buffalo Transit Co.....Cleveland.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL CASTINGS.
Seaboard Steel Casting Co.....Chester, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.
American Bridge Co.....New York.

SUBMARINE DIVING APPARATUS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

SURVEYORS, MARINE.
See, Horace.....New York.
Wood, W. J.....Chicago.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.
Standard Pneumatic Tool Co.....Chicago.
Watson-Stillman Co.....New York.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Atlantic Works, Inc.....Philadelphia.

TOPOPHONE—Prevents disasters in fogs.
Colt Co. J. B.....New York.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

TRAPS, STEAM.
D'Este Co., Julian.....Boston.
Haines Co., Wm. S.....Philadelphia.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.
Benedict & Burnham Mnfg. Co.....Waterbury, Conn.
Standard Seamless Tube Co.....Pittsburg.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crane Co.....Chicago.
Crosby Steam Gage & Valve Co.....Boston.
D'Este Co., Julian.....Boston.
Jenkins Bros.....New York.
Wood & Co., R. D.....Philadelphia.

VARNISH MAKERS, COLOR GRINDERS, ETC.
Smith, Edward & Co.....New York.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Hall & Root.....Buffalo.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Kennedy Hunter & Co.....Antwerp.
Mitchell & Co.....Cleveland.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

VENTILATING APPARATUS FOR SHIPS.
American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

Almy Water Tube Boiler Co..... 11
American Blower Co..... 40
*American Bridge Co..... 26
American Line 7
American Ship Building Co..... 1
American Ship Windlass Co..... 2
American Steam Gauge Co..... 1
American Steel & Wire Co..... 1
Armstrong Cork Co..... 40
Ashton Valve Co..... 12
Atlantic Works 5
*Atlantic Works, Inc..... 7

Babcock & Wilcox Co..... 11
Baldt Anchor Co..... 9
Baker, Howard H. & Co..... 6
Bath Iron Works, Ltd..... 1
Bement, Miles & Co.....
Benedict & Burnham Mnfg. Co..... 28
Bertram's Oil Polish Co..... 1
Bessemer Steamship Co..... 8
Big Four Railway..... 39
Blake, Geo. F., Mnfg. Co..... 9
*Bliss, John & Co..... 30
*Bloomsburg & Co., H..... 31
Boland, J. J..... 34
Boston Blower Co..... 4
*Boston & Lockport Block Co..... 40
*Boyer Water Tube Boiler Co..... 31
Bourne-Fuller Co..... 12
Brown & Co..... 34
Brown Hoisting Machinery Co., Inc.... 2
Buffalo Dry Dock Co..... 11
Buffalo Forge Co..... 12
Bullock Electric Mnfg. Co..... 1

Castner, Curran & Bullitt..... 33
Chamberlain & Co., S. R..... 34
Champion Rivet Co..... 8
Chase Machine Co..... 8
Chicago Ship Building Co..... 2
Clayton Fire Extinguishing & Disinfecting Co..... 31
Cleveland & Buffalo Transit Co..... 31
Cleveland City Forge & Iron Co..... 6
Cleveland Punch & Shear Works Co.... 28
C. C. C. & St. L. R. R..... 39
Cole & Kuhls..... 9
Coleman & Sons, Walter..... 40
Colt Co., J. B..... 10
Continental Iron Works..... 2
Cory, Chas. & Son..... 10
*Craig Ship Building Co..... 30
Cramp, Wm. & Sons, S. & E. B. Co.... 1
Crandall & Son, H. I..... 7
Crane Co..... 6
Crosby Steam Gage & Valve Co..... 12

Dearborn Drug & Chemical Works..... 30
D'Este Co., Julian..... 3

Delauney, Belleville & Co..... 27
Delaware River Iron S. B. & E. Works. 5
Detroit Shipbuilding Co..... 1
Detroit Screw Works..... 11
Dixon Crucible Co., Joseph..... 9
Donnelly Salvage & Wrecking Co..... 32
Drake & Maytham..... 34
Drein, Thos. & Son..... 4
Duluth, South Shore & Atlantic Ry..... 39

Electro-Dynamic Co..... 1
Elphicke, C. W. & Co..... 34
Elwell-Parker Electric Co..... 2
Erie & Western Trans. Co..... 32

Falls Hollow Staybolt Co..... 4
Farrar & Trefts..... 5
Fields, J. M..... 34
Fletcher, W. & A. Co..... 4
Fogg, M. W..... 31
Fore River Ship & Engine Co..... 5

Garlock Packing Co..... 28
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated..... 31
General Electric Co..... 12
Gilchrist, Albert J..... 34
*Gleason-Peters Air Pump Co..... 29
Goerz, G. P..... 9
Goulder, Holding & Masten..... 34
Graphite Lubricating Co..... 9
Great Lakes Register..... 7

Haines Co., Wm. S..... ..
Hale Rubber Co., Alfred..... 9
Hall & Root..... 34
Hanna, M. A. & Co..... 32
Hardy, John B..... 4
Harlan & Hollingsworth Co., The..... 5
Helios-Upton Co..... 8
Helm, D. T. & Co..... 34
Herriman, F. D..... 7
Hodge, S. F. & Co..... 8
Holmes, Samuel..... 34
Holtzer-Cabot Electric Co..... 2
Hoyt, Dustin & Kelley..... 34
Hunt, Robert W. & Co..... 34
Hutchinson & Co..... 34
Hyde Windlass Co..... 40

International Anchor Co..... 9
International Navigation Co..... 7

Jenkins Brothers.....10-12
Jenks Ship Building Co..... 39

Kahnweiler's Sons, David..... 4
Katzenstein, L. & Co..... 4
Keith, J. G. & Co..... 34
Kennedy Hunter & Co..... 3
Kingsford Foundry & Machine Works.. 30

Lake Shore Engine Works..... 1
Lane & DeGroot..... 4
*Learmonth, Robert..... 30
Lidgerwood Mfg. Co..... 10
Lockwood Mnfg. Co..... 4
"Long Arm" System Co..... 3
L. S. & M. S. Ry..... 39

MacDonald, Ray G..... 34
MacKinnon Mfg. Co..... 8
Mair, John & Son..... 6
*Marine Iron Co..... 7
Martin-Barriss Co..... 8
Maryland Steel Co..... 5
Merrell Mnfg. Co..... 5
Midland Towing & Wrecking Co., Ltd.. 40
Miller, Walter..... 9
Mitchell & Co..... 34
Monongahela Iron & Steel Co..... 3
*Moran Bros. Co..... 39
*Mott Iron Works, J. L..... 10
Mulholland, M..... 33

Neafie & Levy Co..... 5
*Newhall Chain Forge & Iron Co..... 30
Newport News Ship Building & Dry Dock Co..... 5
New York Mallet & Handle Works..... 30
Niles Tool Works Co..... 3
Nixon, Lewis..... 5
North River Iron Works..... 4

Ohio Fuel Co..... 32
Olds Motor Works..... ..
Osborne & Co., F. H..... 34

Page Bros. & Co..... 3
Parker, A. A. & B. W..... 32
Paul & Co., J. C..... 28
Peck, Chas. E. & W. F..... 7
Phosphor Bronze Smelting Co., Ltd..... 8
Pickands, Mather & Co..... 32
Pinney, Orestes C..... 34
Pittsburg Coal Co..... 33
Pittsburgh Testing Laboratory, Ltd..... 34
Pond Machine Tool Co.....
Porter's Sons' Co., Wm..... 4
Powell, Ambrose V..... 34
Pratt & Whitney Co.....
Pusey & Jones Co..... 5

Queen City Engineering Co..... 10

Red Star Line..... 7
*Reilly Repair & Supply Co., James.... 10
Reynolds, H. J..... 9
Richardson, W. C..... 34
Risdon Iron Works..... 5
*Ritchie & Sons, E. S..... 30
Roach's Ship Yard..... 5
Roberts Water Tube Boiler Co..... 11
Rochester & Pittsburgh Coal & Iron Co. 33
*Roebling's, John A. Sons Co..... 40
Rushmore Dynamo Works..... 4

Safety Car Heating & Lighting Co..... 31
Sands, Alfred B. & Son..... 10
Sayen & Schultz..... 1
Scherzer Rolling Lift Bridge Co..... 6
Scott Co., The W. L..... 32
Seaboard Steel Casting Co..... 29
See, Horace..... 34
Seidler-Miner Electric Co..... 8
Sheriffs Mfg. Co..... 10
Shipowners Dry Dock Co..... 12
*Signal & Control Co..... 7
Skinner Chuck Co..... 3
Smith, Edward & Co..... 1
Smith, Stanley B. & Co..... 33
Standard Chain Co..... 10
*Standard Oil Co..... 3
Standard Releasing Hook Co..... 2
*Standard Pneumatic Tool Co..... 26
Standard Seamless Tube Co..... 29
Sterling, Welch & Co..... 32
Stirling Co..... 11
Stowe & Graydon..... 34
Stratford Oakum Co., Geo..... 31
Sturtevant, B. F. Co..... 40
Sullivan & Co..... 34
Swain Wrecking Co..... 32

Thurston & Bates..... 34
Trigg Co., Wm. R..... 4
Trout, H. G..... 9

Union Iron Works..... 5
Upson-Walton Co..... 40
U. S. Metallic Packing Co..... 40

Walker, Thomas & Son..... 3
Watson-Stillman Co..... 39
Westinghouse Electric & Mnfg. Co..... 6
Wheeling & Lake Erie R. R..... 39
White, Johnson, McCaslin & Cannon... 34
Willard, Chas. P. & Co..... 30
Williams & Rodgers Co..... 32
Wilson, Thomas..... 34
Wilson & Silsby..... 6
Wood, W. J..... 34
*Wood & Co., R. D..... 30
Worthington, Henry R..... 9
Wright, Herbert & Co..... 34

Youghiogheny & Lehigh Coal Co..... 33

HYDRAULIC MACHINERY, TOOLS AND SUPPLIES

FOR MARINE AND SHIP YARD USE.

The WATSON-STILLMAN CO.

204 to 210 E. 43rd St., NEW YORK.

LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

CLEVELAND CITY TICKET OFFICE 237 SUPERIOR ST

Eastward:—	Ar. fr. West.	Dep. East.
No. 18, Southwestern Limited	.....	*1 55 am
No. 22, Lake Shore Limited	*2 15 am	*2 20 am
No. 26, Pan-American Express	*5 50 am	*6 00 am
No. 28, New York & Boston Express	*7 40 am	*8 00 am
No. 32, Fast Mail	*11 25 am	*11 30 am
No. 44, Accommodation, via Sandusky	†1 35 pm	.....
No. 46, Southwestern Express	.....	*3 00 pm
No. 6, Limited Fast Mail	*5 40 pm	*5 45 pm
No. 10, Chicago, New York & Boston Special	*7 35 pm	*7 40 pm
No. 16, New England Express	*10 30 pm	*10 35 pm
No. 2, Day Express	†9 05 pm	†11 30 pm
No. 126, Norwalk Accommodation	†7 55 am	.....
No. 40, Toledo & Buffalo Accom., via Norwalk	†10 00 am	†11 40 am
No. 106, Conneaut Accommodation	.....	†4 30 pm
Westward:—	**Ar. fr. East.**	**Dep. West.**
No. 11, Southwestern Limited	*3 25 am	.....
No. 15, New York, Boston & Chicago Special	*3 05 am	*3 10 am
No. 21, New York & Chicago Express	*5 10 am	*5 20 am
No. 7, Day Express	.....	†6 30 am
No. 19, The Lake Shore Limited	*7 35 am	*7 40 am
No. 23, Western Express	*11 10 am	*11 15 am
No. 33, Southwestern Express	*12 25 pm	.....
No. 133, Cleveland & Detroit Express	.....	*12 30 pm
No. 47, Accommodation	.....	†3 00 pm
No. 141, Sandusky Accommodation	.....	†3 10 pm
No. 127, Norwalk Accommodation	.....	†5 10 pm
No. 37, Pacific Express	*7 00 pm	*7 20 pm
No. 25, Southern Express	*9 30 pm	.....
No. 3, Fast Mail Limited	*10 50 pm	*10 55 pm
No. 115, Conneaut Accommodation	†8 30 am	.....

*Daily. †Daily except Sunday. Trains Nos. 28 and 37 run via Erie station.

HALF RATES to Old Point Comfort, Va., AND RETURN

VIA "BIG FOUR ROUTE"

ON ACCOUNT OF

Travelers' Protective Association of America,

JUNE 3rd to 8th, 1901.

Round trip tickets to Old Point Comfort, Va., will be on sale on May 31st and June 1st and 2nd from all "Big Four" points at rate of one fare for the round trip. Tickets good for return until June 30th, 1901. For full information and particulars as to rates, tickets, limits, etc., call on Agents "Big Four" Route, or address the undersigned.

WARREN J. LYNCH, Genl. Pass. & Tkt. Agt. CINCINNATI, O.
W. P. DEPPE, A. G. P. & T. Agt. CINCINNATI, O.
D. JAY COLLYER, C. P. & T. A. 116 Euclid Ave. CLEVELAND.

OPERATES THE ONLY THROUGH

BUFFET PARLOR CAR LINE

Between Cleveland, Canton and Wheeling.

J. N. MERWIN, G. P. A.
E. B. COOLIDGE, A. G. P. A.
CLEVELAND, O.

WANTED, FOR SALE FOR CHARTER, Etc.

Space under this heading 25 cents a line, each insertion, for three insertions or less. Special rates for periods of more than three insertions.

—WANTED—Great Lakes Towing Co. stock. State price and number of shares. Address Manhattan, care Marine Review Pub. Co., Perry-Payne building, Cleveland, O. June 6

—FOR SALE—New locomotive fire-box boiler. Fire-box 84½ in. long, 89 in. high, 64 in. wide. Contains 237 2¼ in. by 17 ft. iron tubes. Steam drum 36 in. diameter, 11 ft. long. Working pressure, 200 lbs. The S. Freeman & Sons Mn'fg. Co., Racine, Wis tf.

—FOR SALE—Tug Maurice W. Practically a new boat; 50 ft. over all, 12 ft. beam, 5 ft. draught. Swings a 4-ft. wheel. Machinery built by Sutton Bros. Price, $1600 cash. L. E. Welch, Mackinaw City, Mich. June 13.

—FOR SALE OR CHARTER—British steamer of Welland canal dimensions; about 3,250 gross tons capacity, carrying about 2,000 gross tons on 14 ft. (fresh water) draught. Speed 10 knots loaded; easy consumption. Large hatchways. Address "Charter," The Marine Review Pub. Co., Cleveland. June 7.

—FOR SALE—Balanced compound marine engines, 20 to 200 H.P. Immediate delivery. Patterns for larger sizes and for quadruple expansion engines. Wells Engineering Co., 136 Liberty street, New York City. July 25.

—WANTED—Agents to call on all consumers of polishes, particularly yachts, steamers, etc. Bertram's Oil Polish Co., Boston, Mass. tf

—FOR SALE—Complete plant for steel ship building. P. O. Box 23, Perth Amboy, N. J.

—FOR SALE—Harbor tugs Owen and Delta. Engines 20x20 and 20 x22 in., respectively. Good boats. Cheap for cash. Ranney Bros., 65 Merwin St., Cleveland. tf.

—FOR SALE—Scott's Coast Pilot, 1901 edition. Great lakes and connecting waters. Fully revised. Price, $1.50. The Marine Review Pub. Co., Cleveland. tf

—FOR SALE—Charts of all the world. Charts of the great lakes always in stock. United States Hydrographic Office charts, Coast Survey charts, Army Engineer charts. We bind charts and back them with tape, so that they will last for years. The Marine Review Pub. Co., Cleveland. tf

THE Marquette ROUTE

DULUTH, SOUTH SHORE AND ATLANTIC RAILWAY.

The Only Line Reaching **MARQUETTE, MICH.**

"The Queen of Northern Summer Resorts."

Hotel Accommodations thoroughly first-class, headed by the Hotel Superior, the finest Hostelry on the Great Lakes.

GEO. B. ROSS, Lessee, HOTEL SUPERIOR, MARQUETTE, MICH.; Proprietor LEXINGTON HOTEL, CHICAGO, ILL.; formerly Manager CHICAGO BEACH HOTEL

——WRITE THE UNDERSIGNED FOR ILLUSTRATED PUBLICATIONS.——

E. C. OVIATT, Trav. Pass. Agent, 76 Ottawa St., GRAND RAPIDS, MICH.
G. A. CLIFFORD, Trav. Pass. Agent, CINCINNATI, OHIO.
A. E. EDMONDS, City Pass. Agent, DETROIT, MICH.
F. W. SALSBURY, Commercial Agent, PITTSBURG, PA.
J. F. LEE, Gen'l Agt. Pass. Dept., 228 So. Clark St., CHICAGO, ILL.
GEO. W. HIBBARD, Gen'l Pass. Agent, MARQUETTE, MICH.

W. S. JENKS, President.
O. L. JENKS, Vice-Pres. and Treas.
A. M. CARPENTER, Sec. and Gen'l Mgr.

The Jenks Ship Building Co.

Office and Machine Shops at Fourth St. Yards: Foot of Lincoln Ave.

PORT HURON, MICH.

Steel and Wood Ship Builders.
Marine Engines and Boilers.

STEAM WINDLASSES,
CAPSTANS AND
STEERING APPARATUS.

PROMPT ATTENTION GIVEN TO REPAIRS OF ALL KINDS ON SHIPS, ENGINES AND BOILERS.

Lake Erie R. R. AND Wheeling

STURTEVANT BLOWERS

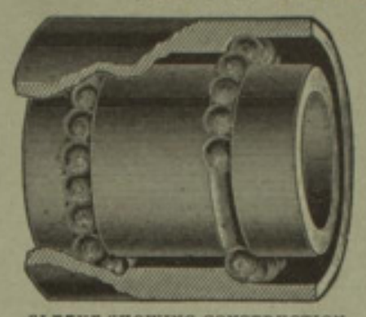
ENGINES
MOTORS
GENERATING SETS
FORGES
STEAM HEATING APPARATUS
&c

·196·

B·F·STURTEVANT·Co
BOSTON·MASS·U·S·A
NEW YORK ♀ PHILADELPHIA ♀ CHICAGO ♀ LONDON

The Upson-Walton Co.,

155-161 RIVER STREET, CLEVELAND, OHIO,



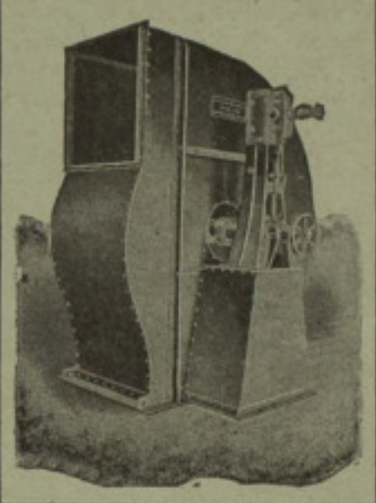
SLEEVE SHOWING CONSTRUCTION.

BALL BEARING SHEAVES, THE LATEST IMPROVEMENT

SELL THE

Cleveland Block

TO BE FOUND ON NEARLY ALL THE MODERN LAKE VESSELS.



Steel Plate Fans

For VENTILATION and MECHANICAL DRAFT

Send for copy of our sectional catalogue No. 118 N on Mechanical Draft.

American Blower Co.
DETROIT, MICH.
New York. Chicago. London.

L.L. CLINE. Adv. Dep.

U. S. METALLIC PACKING CO.

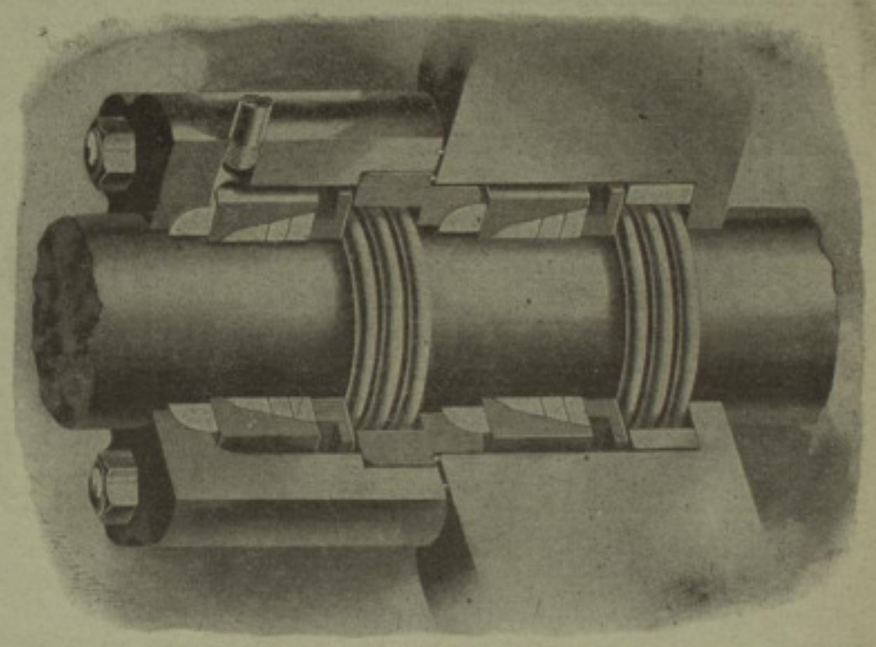
429 N. 13th St. PHILADELPHIA PA.

120,000 PACKINGS IN USE.
12,000 APPLIED IN 1899.

Extensively Used on Ocean, Lake, and Stationary Engines.
Cheap, Durable and Small Cost for Repairs.

Silver Medal Awarded Paris, 1900.

SEND FOR CATALOGUE.



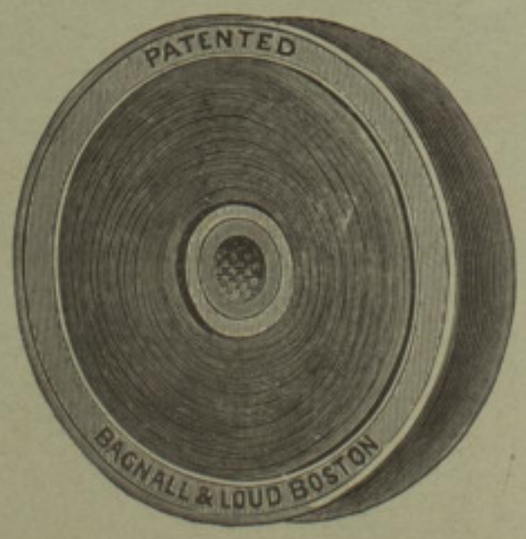
COLEMAN'S BLOCKS

NEW WRINKLES

NEW STYLE CARGO HOISTING BLOCKS

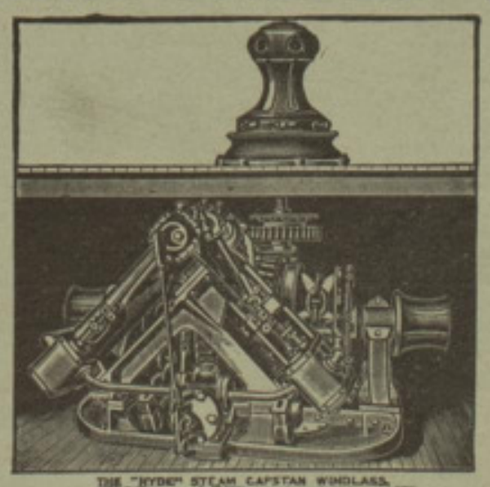
with Wooden Cheeks, Malleable Iron Frame, Wrought Iron Straps, and fitted with new style metaline sheaves, which have lignum vitae cheeks.

Free Illustrated 112-page Catalogue AX. on application.



Manufactured Only by .... BOSTON AND LOCKPORT BLOCK CO., Boston, Mass., and Lockport, N. Y.

WINDLASSES AND CAPSTANS



THE "HYDE" STEAM CAPSTAN WINDLASS.

The Hyde Steam and Power Windlasses and Capstans are the best in the market.

They have been selected for most of the vessels now building for the Navy Department, Revenue Marine, Light-house Board and United States Coast Survey

They are being furnished for the majority of the highest class Steam Ships, Merchant Vessels and Yachts now building.

HYDE WINDLASS CO., Bath, Me.

LIFE PRESERVERS—BUOYS.

Acme, Solid Cork. Granulated Cork.

EACH PRESERVER stamped by United States Inspector guaranteeing proper buoyancy. Cork Filled Yacht Fenders. Cork Mooring Buoys. Material and Finish Guaranteed. Orders filled promptly.

ARMSTRONG CORK COMPANY,

Boston. New York. Philadelphia. Pittsburg. Chicago. St. Louis. Baltimore.

Midland Towing & Wrecking Co., Ltd.

MIDLAND, ONT., CANADA.

JAMES PLAYFAIR, { Pres't and Gen. Mngr.
D. L. WHITE, Vice-Pres.
J. W. BENSON, Sec'y and Treas.

FIRST-CLASS TUGS FOR WRECKING, RAFT TOWING, ETC.

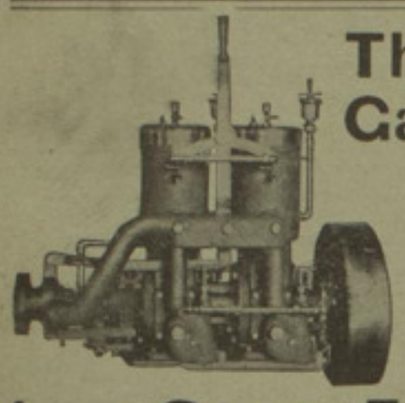
STEAM PUMPS, DIVERS, JACKS, HAWSERS, LIGHTERS.

THE BEST 1901 CATALOGUE TELLS THE REST
1778-1901
Walter Coleman & Sons,
PROVIDENCE, RHODE ISLAND.

ARE ACKNOWLEDGED THE
WE BLOCK THE CUP DEFENDERS

MARINE REVIEW

VOL. XXIII. CLEVELAND, O., JUNE 6, 1901. No. 23



The Superior Marine Gasoline Engine

IS BUILT FOR HEAVY SERVICE.

Every sail boat and steamer should carry one in a tender. Small schooners save tug bills. One in a delivery boat pays for itself the first year. Built in single, double and triple cylinders. Send for catalogue and description of how it acted in a U. S. life-boat.

LAKE SHORE ENGINE WORKS, Marquette, Mich.

The Wm. Cramp & Sons Ship and Engine Building Co.

PHILADELPHIA.

SOLE MANUFACTURERS IN AMERICA OF

Parsons Manganese Bronze AND Parsons White Brass.

EDWARD W. HYDE, President. H. H. McCARTY, Treasurer.
JOHN S. HYDE, Vice-Pres. and Gen'l Supt.

BATH IRON WORKS, Ltd.

Ship Builders and Engineers,

BATH, MAINE.

W. L. BROWN, President.
R. L. IRELAND, Vice-president.
R. C. WETMORE, Sec'y and Treas.
JAS. C. WALLACE, Gen'l Manager.

DRY DOCKS IN CLEVELAND:
No. 1, foot Weddell St., 440 ft. x 50 ft. x 16 ft.
No. 2, foot Weddell St., 300 ft. x 55 ft. x 13 ft.
No. 3, Elm St., 340 ft. x 50 ft. x 13 ft.
Dry Dock at Lorain: 560 ft. x 60 ft. x 17 ft.

The American Ship Building Co.

OFFICE, 120 VIADUCT, CLEVELAND, O.

STEEL SHIPS

MARINE AND STATIONARY ENGINES.
BOILERS AND AUXILIARY MACHINERY.

PROMPT ATTENTION GIVEN TO SHIP REPAIRS OF ALL KINDS.

WORKS AT CLEVELAND AND LORAIN.

THE ELECTRIC STEERING GEAR.

CIRCULARS AND PRICES ON APPLICATION.

The Electro-Dynamic Co.,

212-226 Ionic Street, Philadelphia, Pa., U. S. A.

Cable Address: EDCO, A B C Code 4th Edition.

WIRE HAWSERS RIGGING

GALVANIZED.
STRONGEST.
MOST SATISFACTORY.

AMERICAN STEEL & WIRE COMPANY, - THE ROOKERY, - CHICAGO, ILL.

ALEXANDER McVITTIE, President and Manager.
WILLIAM C. McMILLAN, Vice-President.
CHARLES B. CALDER, General Superintendent.
M. E. FARR, Secretary and Treasurer.
FRANK E. KIRBY, Consulting Engineer.

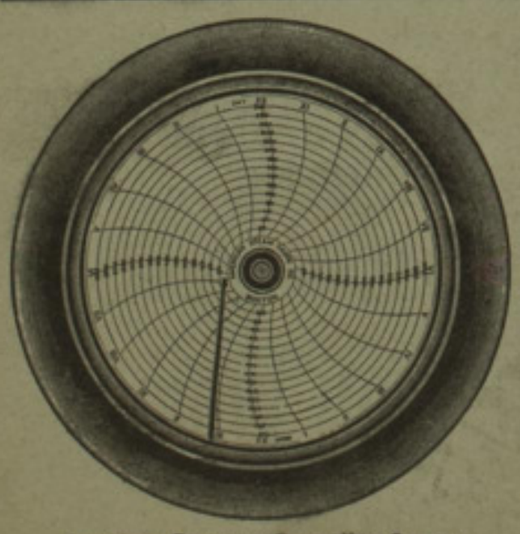
DETROIT SHIPBUILDING COMPANY,

SHIP AND ENGINE BUILDERS,

DETROIT, MICH.

Sole Owners for the Lakes and Atlantic Coast of the HOWDEN HOT DRAFT SYSTEM, as applied to Boilers, giving increased power and great economy.

Steel Ship Yard Located at Wyandotte, Mich.
Wooden Ship Yards and Dry Docks, Foot of Orleans Street, and Foot of Clark Ave., DETROIT, MICH.



American Pressure Recording Gauge.

American Steam Gauge and Valve Mnfg. Co.

(Original Steam Gauge Company.)

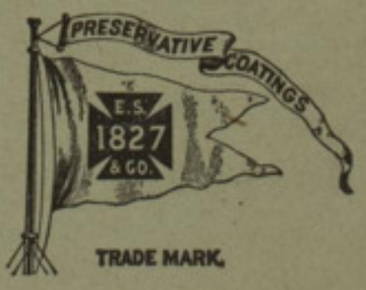
New York. BOSTON. Chicago.

MANUFACTURERS OF

GAUGES THAT GAUGE,
INDICATORS THAT INDICATE,
POPS THAT POP.

Clocks, Revolution Counters, Whistles, and all kinds of Steamship Instruments. Original and only Genuine Thompson Indicator.

HIGHEST AWARD at the PARIS EXPOSITION.
THE ONLY AMERICAN INDICATOR TO RECEIVE A MEDAL.



TRADE MARK.

SPAR COATING.

A perfect finish for all wood work, spars and iron work exposed to excessive changes in weather and temperature.

EDWARD SMITH & CO.,

Varnish Makers and Color Grinders

45 BROADWAY, NEW YORK.

BULLOCK ELECTRIC MNFG. CO.
CINCINNATI, U. S. A.

DIRECT AND ALTERNATING CURRENT EQUIPMENTS
FOR ELECTRIC LIGHT AND POWER.

WAGNER ELECTRIC MNFG. CO.
ST. LOUIS, U. S. A.

Bertram's Polish

EVERY PACKAGE OF BERTRAM'S POLISH, OIL AND PASTE (except 3 and 8-oz. Cans) CONTAINS ONE OF OUR "20TH CENTURY LUCK COINS." TRY A PACKAGE OF THE BEST POLISH IN THE WORLD AND SECURE YOUR CENTURY'S LUCK. ORDER FROM SHIP CHANDLERS AND ENGINEERS' SUPPLIERS.

BERTRAM'S OIL POLISH CO., BOSTON, MASS.

LUCK FOR 20th CENTURY IN MOST POPULAR POCKET PIECE EVER INVENTED.

SAYEN & SCHULTZ,
Mechanical Rubber Works,
PHILADELPHIA, PA.

HOSE, BELTING, VALVES, ETC., FLAX AND GUM CORE PACKINGS FROM FACTORY TO CONSUMER.

RUBBER GOODS

"MELVILLE" PATENT SHEET GUM WITH WIRE GAUZE INSERTION WILL NOT BLOW OUT.

THE BROWN HOISTING MACHINERY CO. INCORPORATED

Engineers, Designers and **Manufacturers** of special machinery for hoisting, conveying, storing and handling material of all kinds under the well-known **"Brownhoist"** patents.

BRIDGE UNLOADERS
for rapidly discharging bulk cargoes from vessels directly to cars or to storage on docks.

FAST PLANT UNLOADERS
for rapidly handling either bulk or package freight.

CRANES
of every description for every kind of service.

Main Office and Works, CLEVELAND, O., U. S. A.

Eastern Office, 26 Cortlandt St., New York City. Pittsburg Office, Carnegie Building, Pittsburg, Pa. European Office, 39 Victoria St., London, S. W.

GENERATORS — ELWELL-PARKER ELECTRIC CO. OF AMERICA MANUFACTURERS GUARANTEES QUALITY CLEVELAND, OHIO. — MOTORS

STANDARD MARINE GENERATING SETS. COMPLETE HOISTING AND POWER PLANTS.

AMERICAN SHIP WINDLASS CO.,

P. O. Box 53, **PROVIDENCE, R. I.**

Send for Catalogue. [Address FRANK S. MANTON, Agent.

Ship Machinery.

Sole Builders of the **ORIGINAL and ONLY AUTOMATIC STEAM TOWING MACHINE.**

WILLIAM L. BROWN, President. B. W. WELLS, Vice-President. O. R. SINCLAIR, Sec'y and Treas. JOHN A. UBSDELL, Jr., Genl. Mngr.

CHICAGO SHIP BUILDING COMPANY,

Long Distance Telephones.
Ship Yard and Dry Dock Office, "South Chicago 40."
Chicago Office, 1125 Rookery, "Harrison" 1207.

STEEL SHIP BUILDERS AND DRY DOCK PROPRIETORS.

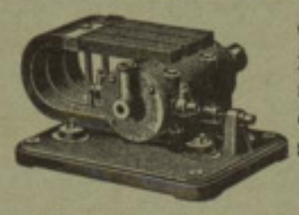
Dry Dock and Yards: 101st St. and Calumet River, CHICAGO, ILL.

Standard Automatic Releasing Device.

THE FALLS ARE SO ROVE THAT BOTH ENDS OF THE BOAT DETACH, IRRESPECTIVE OF WHICH END STRIKES THE WATER FIRST.

Will release a boat immediately in the roughest sea or under speed and can be hooked on without delay or injury to the hands of men hooking it on.

Standard Automatic Releasing Hook Co.,
NEW CHEESEBROUGH BUILDING,
17 State Street, New York, N. Y



A BIG FAT SPARK EVERY TIME
if you use our Magneto Igniter. Expense and annoyance of batteries avoided, and continuous, satisfactory operation of gas or gasoline engine assured. Special styles for automobiles and launches.

Send for our new booklet X for full particulars. It will interest you.

THE HOLTZER-CABOT ELECTRIC CO., BOSTON, (Brookline) MASS.
New York Office, 115 Broadway. Chicago Office, 397 Dearborn St.

Three Excellent Little Books FOR MARINE ENGINEERS.

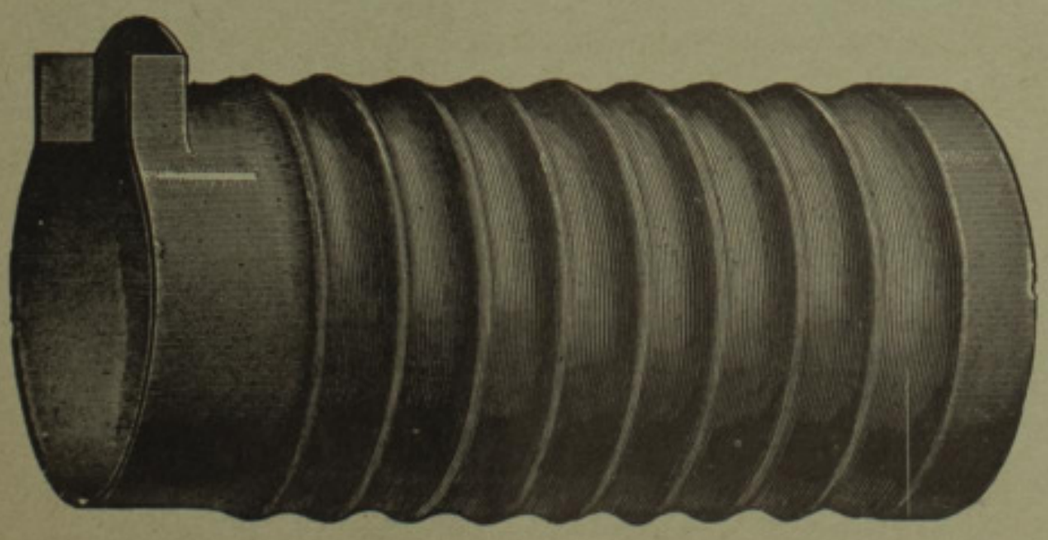
"KEY TO ENGINEERING."

"WHAT AN ENGINEER SHOULD KNOW ABOUT ELECTRICITY."

"ENGINEER'S EPITOME."

Any one of these is worth a dollar. All three may be had for a dollar from the Marine Review Pub. Co., 418-419 Perry-Payne Building, Cleveland.

MORISON SUSPENSION BOILER FURNACES



—FOR—

LAND and MARINE BOILERS.

UNIFORM THICKNESS—EASILY CLEANED
UNEXCELLED FOR STRENGTH.

Also Fox Corrugated Furnaces.

Manufactured by

THE CONTINENTAL IRON WORKS,

West and Calyer Sts. NEW YORK.
Near 10th and 23d Sts. Ferries. Borough of Brooklyn

THE "LONG ARM" SYSTEM CO.

Cor. Lake and Wason Sts., CLEVELAND, O., U S. A.

BUILDERS OF

PNEUMATIC AND ELECTRIC | Safety Power Doors and Hatch Gears for Ships.

SPECIAL AIR COMPRESSORS FOR MARINE WORK.

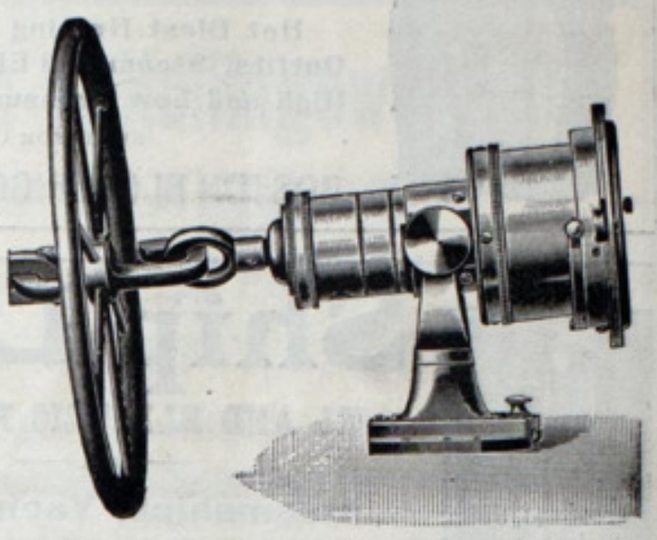
THOMAS WALKER & SON,

BIRMINGHAM, ENGLAND.

THE "NEPTUNE" SHIP-LOG WITH BALL BEARINGS FOR HIGH SPEEDS.

Particulars on Application.

SOLD BY ALL SHIP CHANDLERS.



As used in the British Navy.

To Admiralty Lawyers.

TO ALL LAWYERS, IN FACT, AND ALL OWNERS OF REFERENCE LIBRARIES.

We are offering a nautical encyclopedia, carefully revised, and up to date in all respects. Deals with 5,000 subjects and contains 500 descriptive engravings. Explains every term in the great mass of sea literature.

It should interest every member of the naval, revenue, coast survey, transport and light-house services, for it is an invaluable reference work for them. It goes thoroughly into every feature of these services. It should interest also members of the merchant marine, yachtsmen, builders of steam and sailing vessels and underwriters.

Edited by HOWARD PATTERSON,
Author of several similar works.

JUST FROM THE PRESS.

Price only $3.

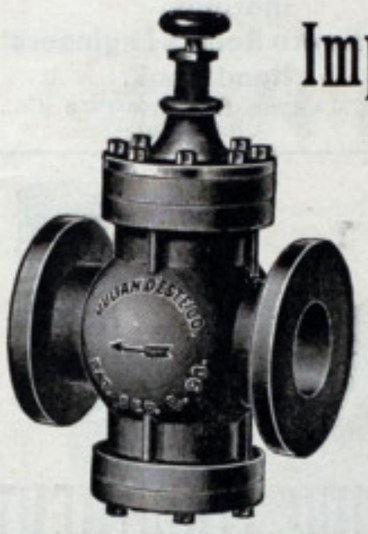
THE MARINE REVIEW PUB. CO.,
CLEVELAND, O.

KENNEDY HUNTER & CO.,

ANTWERP,

SHIP BROKERS, STEAMSHIP AND FORWARDING AGENTS.

AGENTS for BELGIAN, BRAZIL and RIVER PLATE MAIL LINE; MESSRS. LAMPORT & HOLT, of Liverpool; GENERAL STEAM NAVIGATION CO.'S LINE, ANTWERP to LONDON. Regular Lines of Steamers to SPAIN, PORTUGAL, ITALY, MEDITERRANEAN, BLACK SEA, and DANUBE Ports. Direct steamships to BOMBAY and KURRACHEE, CHINA and JAPAN. Direct Sailers to SAN FRANCISCO. Branches:—PARIS, CHARLEROI, BRUSSELS, and RUHRORT.



Improved Pressure Regulator

FOR STEAM.

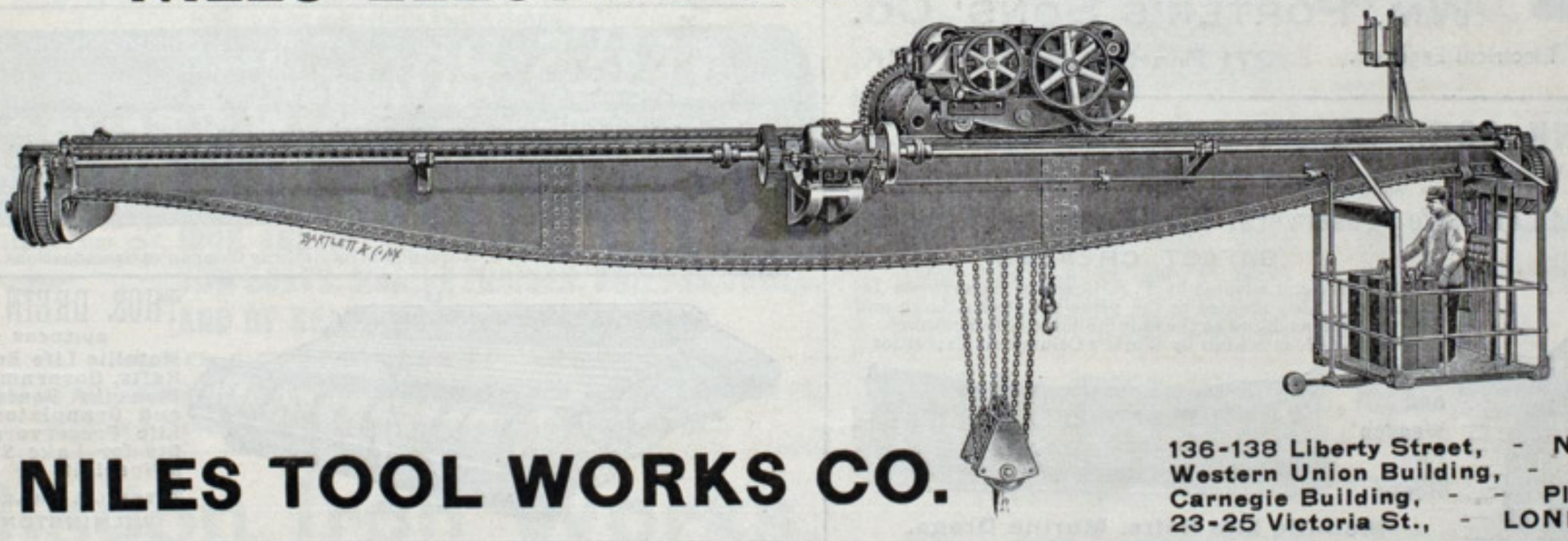
In use on Steamships, for deck machinery, pumps, supplying steam to engines at lower than boiler pressure, for steam heating; or, in any place where it is desired to reduce from a higher to a lower pressure automatically.

SEND FOR CATALOGUE.

JULIAN D'ESTE COMPANY,
24 Canal Street. BOSTON, MASS.

REASONABLE DELIVERIES

NILES ELECTRIC TRAVELING CRANES.



BUILT ON LATEST AND MOST IMPROVED DESIGNS.

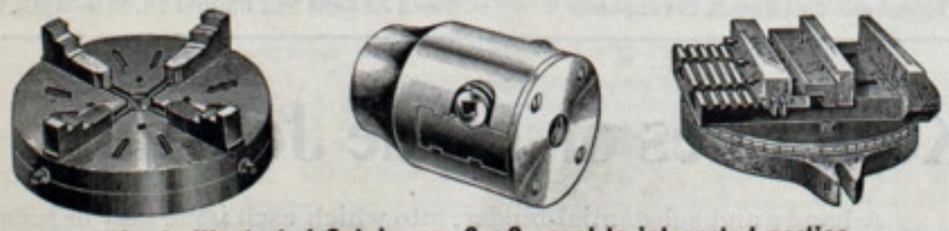
APPLY TO

NILES TOOL WORKS CO.

136-138 Liberty Street, - NEW YORK.
Western Union Building, - CHICAGO.
Carnegie Building, - - PITTSBURG.
23-25 Victoria St., - LONDON, ENG.

SKINNER CHUCKS

For LATHES, DRILLS and PLANERS



A finely illustrated Catalogue, 6 x 9, sent to interested parties.

THE SKINNER CHUCK CO., 340 CHURCH STREET. NEW BRITAIN, CONN.

Monongahela Iron and Steel Co.

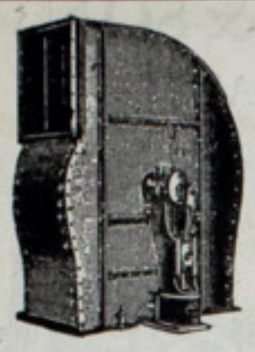
MANUFACTURERS OF

CHARCOAL BAR IRON **CARTER BRANDS** CHARCOAL IRON CHAINS

ALL SIZES.

United States Government Specifications Guaranteed.

PITTSBURGH, PA.



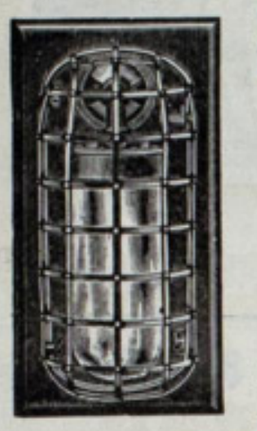
Fan and Pressure Blowers,

EXHAUST FANS FOR ALL USES.

Hot Blast Heating Apparatus, Dry Kiln Outfits, Steam and Electric Fans, Forges, High and Low Pressure Engines.

SEND FOR CIRCULARS.

BOSTON BLOWER CO., Hyde Park, Mass.



Ship Lamps

OIL AND ELECTRIC FIXTURERS

— FOR —

Steamships, Yachts, &c.

GREAT VARIETY OF DESIGNS.

Prices and Cuts on Application.

PAGE BROS. & CO.

347 to 357 Cambridge St. Boston, Mass.

SEARCH LIGHTS - - -

RUSHMORE PROJECTORS are in almost exclusive use in all classes of service, and are specified for finest Steamers and Yachts.

RUSHMORE DYNAMO WORKS,

TELEPHONE 559. JERSEY CITY.

Reed's Engineers' Hand Book.

Reed's Guide to Examinations.

Key to Reed's Engineers' Hand Book.

MARINE REVIEW PUB. CO., Cleveland, O.

MARINE LIGHTING EQUIPMENT.

WM. PORTER'S SONS' CO.

F. J. RUSSELL, Electrical Engineer. 271 Pearl St., NEW YORK.

NEVERSINK CORK JACKET AND LIFE BELT.

Warranted 24 pounds. Buoyancy and full Weight of Cork, as required by U. S. Inspectors.

Consolidated Cork Life Preservers. Ring Buoys and Fenders.

SAFEST, CHEAPEST.

Approved and adopted by U. S. Board of Supervising Inspectors. Also adopted by the principal Ocean, Lake and River Steamer Lines as the only Reliable Life Preserver. Awarded four Medals by World's Columbian Exposition.

Metallic and Wooden Life Boats.

Metallic Life Rafts. Marine Drags.

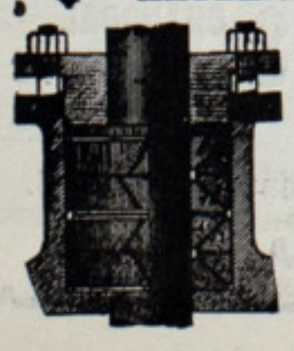
Manufacturers of Woolsey's Patent Life Buoy—the lightest, cheapest and most compact Life Raft known.

DAVID KAHNWEILER'S SONS

437 Pearl Street, NEW YORK CITY.

Send for Illustrated Catalogue.

KATZENSTEIN'S Self-Acting METAL PACKING,



For PISTON RODS, VALVE STEMS, etc., of every description, for Steam Engines, Pumps, etc., etc.

Adopted and in use by the principal Iron Works and Steamship Companies, within the last twelve years, in this and foreign countries.

FLEXIBLE TUBULAR METALLIC PACKING, for slip-joints on Steam Pipes, and for Hydraulic Pressure; also METAL GASKETS for all kinds of flanges and joints.

DOUBLE-ACTING BALANCED WATER-TIGHT BULKHEAD DOORS for Steamers. Also Agents for the McColl Cumming PATENT LIQUID RUDDER BRAKE. For full particulars and reference, address:

L. KATZENSTEIN & CO.,

General Machinists, Brass Finishers, Engineers' Supplies,

357 West St., New York.

THE LOCKWOOD MANUFACTURING CO.

IRON WORKS AND DOCKS,

61 to 85 Sumner Street, EAST BOSTON, MASS.

BUILDERS OF

Steamships, Tow Boats and Marine Engines.

REPAIRING OF EVERY DESCRIPTION.

Builders of the Celebrated LOCKWOOD PROPELLER WHEELS.

WM. R. TRIGG COMPANY,

SHIP BUILDERS, RICHMOND, VA.

Government Contractors,

Building United States Torpedo Boats

SHUBRICK, STOCKTON and THORNTON,

and Torpedo Boat Destroyers DALE and DECATUR.

SHIPBUILDING IN ALL ITS BRANCHES.

W. & A. FLETCHER CO.

NORTH RIVER IRON WORKS.

Marine Engines, Boilers, Etc.

Hudson, 12th and 14th Streets, Hoboken, N. J.

Take Ferry from foot of West 14th Street, N. Y

JOHN B. HARDY, BUILDER OF STEAM VESSELS

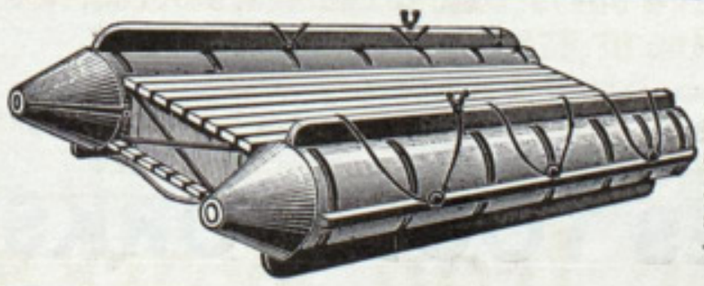
EITHER STEEL OR WOOD.

All kinds of Marine Engines and Machinery. Finest Equipped Shop on Puget Sound. Marine Shears of 125 tons capacity .First-class rail facilities.

TACOMA, WASHINGTON.

Guaranteed to pass U. S. Government or Railway Companies Specifications

---



THOS. DREIN & SON,

BUILDERS OF

Metallic Life Boats and Rafts, Government and Pleasure Boats, Block and Granulated Cork Life Preservers. Outfits for Lake Steamers a Specialty.

TATNALL & RAILROAD STS

WILMINGTON, DEL.

Telephone Call 340-B, Greenpoint.

LANE & DeGROOT,

METALLIC LIFE BOATS,

(Formerly Raymond's)

Metallic Life Rafts, Cork Life Preservers, Etc., approved by the U. S. Supervising Inspectors. Also Wood Boats of Every Description. Repairing of every kind promptly attended to.

70 and 72 Kent St., BROOKLYN, NEW YORK.

Keep Files of Trade Journals.

A handy and substantial binder, into which each issue may be securely and neatly placed with trifling effort, may be had at $1. Thousands of them in use.

THE MARINE REVIEW PUB. CO., Perry-Payne Building, Cleveland.

ROACH'S SHIP YARD.

DELAWARE RIVER
IRON
SHIP-BUILDING & ENGINE WORKS,
CHESTER PA.

Builders of Steamships and Marine Machinery.

SHIP-BUILDING IN ALL ITS BRANCHES.

New York Office, Morgan Iron Works, Foot East Ninth St

SHIP AND ENGINE BUILDERS.

Newport News Shipbuilding and Dry Dock Company.

Equipped with a Simpon's Basin Dry Dock capable of docking a vessel 600 feet long drawing 25 feet of water, at any stage of the tide Repairs made promptly and at reasonable rates.

For estimates and further particulars, address

C. B. ORCUTT, President,
NO. 1 BROADWAY, NEW YORK.

WORKS AT NEWPORT NEWS, VA.
(ON HAMPTON ROADS.)

MARYLAND STEEL CO.,

Marine Department.

Ship Builders and Engineers

SPARROW'S POINT, MD.

Baltimore Telephone No. 11. A. G. WILSON, Manager.

Long Distance Telephone Service Between New York, Philadelphia, Boston and Sparrow's Point Offices.

New York Office: 71 Broadway. Boston Office: 70 Kilby Street.
Philadelphia Office: 312-319 Girard Building.

The Pusey & Jones Company,

WILMINGTON, DELAWARE.

Builders of **IRON AND STEEL STEAMERS, STEAM YACHTS, TOW BOATS, MARINE ENGINES, BOILERS, TANKS, AND OF HEAVY MACHINERY GENERALLY.**

ALSO COPPERSMITH WORK.

SPECIAL FACILITIES for REPAIRS to both WOODEN and METAL BOATS.

MARINE RAILWAY. NO WHARFAGE CHARGED.

Risdon Iron Works,

IRON AND STEEL SHIP BUILDERS,

SAN FRANCISCO.

FORE RIVER SHIP AND ENGINE COMPANY,

SUCCESSORS TO Fore River Engine Co.

Steel Ship and Marine Engine Builders.

CONTRACTORS FOR { U. S. Torpedo Boat Destroyers Lawrence and Macdonough. / U. S. Protected Cruiser Des Moines / U. S. Battleships New Jersey and Rhode Island. / U. S. Steam Light-Vessel No. 72.

OFFICE AND WORKS: QUINCY, MASS., U. S. A.

FARRAR & TREFTS,

Propeller, Yacht and Tug Wheels.
Marine and Stationary Engines & Boilers.
Repairing Promptly Attended to.
Drilling Boilers and Engines a Specialty.

64 to 66 Perry Street, BUFFALO, N. Y.

WORKS AND MAIN OFFICE, **WILMINGTON, DEL.**

The Harlan & Hollingsworth Co.

SHIP BUILDERS,
DRY DOCKING, REPAIRING AND OUTFITTING.

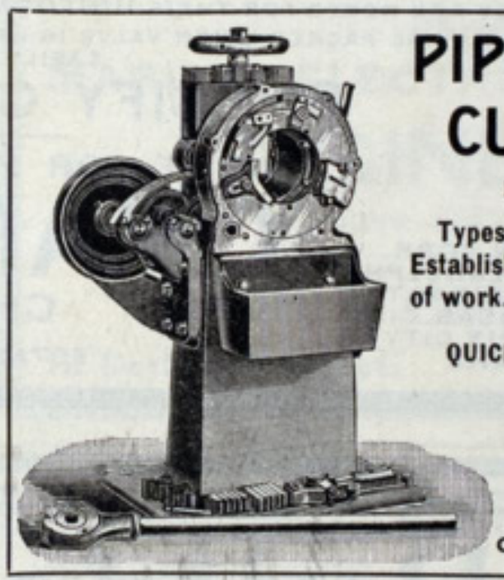
(3-4 CENTURY EXPERIENCE.)

NEW YORK OFFICE, { EXCHANGE COURT BUILDING, 52 BROADWAY, ROOM 702.

UNION IRON WORKS

SHIP BUILDERS,

SAN FRANCISCO.



PIPE THREADING AND CUTTING MACHINES

HAND OR POWER.

Types combining all that is LATEST and BEST. Established reputation for durability and rapidity of work.

GREAT RANGE OF WORK.
QUICK CHANGE FROM SIZE TO SIZE OF PIPE.
GEARS COMPLETELY HOUSED.

MERRELL MNFG. CO.

SEND FOR CATALOGUE R. Toledo, Ohio, U. S. A.

MATHIAS SEDDINGER, President.
SOMMERS N. SMITH, Vice-Pres't and Gen'l Mgr. ESTABLISHED 1838.

THE NEAFIE & LEVY SHIP & ENGINE BUILDING COMPANY,

PENN WORKS.

IRON AND STEEL SHIP AND MARINE ENGINE BUILDERS.

SOLE MAKERS OF THE WELL KNOWN

PHILADELPHIA PROPELLER WHEEL.

Beach and Palmer Streets, PHILADELPHIA, PA., U. S. A.

The Atlantic Works,

BUILDERS OF ..... STEAMSHIPS, STEAM YACHTS, TOW BOATS, ETC.

EAST BOSTON, MASS.

Marine Engines, Boilers and Tanks,
Heavy Machinery and Plate Iron Work.

LEWIS NIXON, SHIP BUILDER

Office and Works, ELIZABETH, N. J.

Builder of Stern-wheel, Paddle and Screw Steamers; also Torpedo Boats and Barges of all kinds in Steel.

A Specialty made of South American and Alaskan River Boats.

Patterson's Nautical Encyclopedia.

Will be in all respects a work up to date, correct as to every term known to the shipping world.

Divided as to departments of Naval Architecture, Marine Engineering, etc.

The latest and bound to be the most complete work of its kind. Best effort of Howard L. Patterson, New York, author of several standard books on marine subjects.

NOW IN PRESS. $3 PER COPY.

Order from THE MARINE REVIEW PUB. CO., CLEVELAND.

As complete in everything pertaining to naval architecture and marine engineering, as it is in sea terms. No expense spared in illustrations. Special attention given to the modern steel ship. A work that may well be recommended to admiralty lawyers.

WILSON & SILSBY, Rowe's Wharf, BOSTON, MASS.

MAKERS OF

Sails for Yacht Independence.

ALSO THE

OUTFITS OF LARGE STEAM YACHTS.

THE CHASE MACHINE COMPANY,

Engineers and Machinists,

MANUFACTURERS, UNDER THE CHASE PATENTS OF

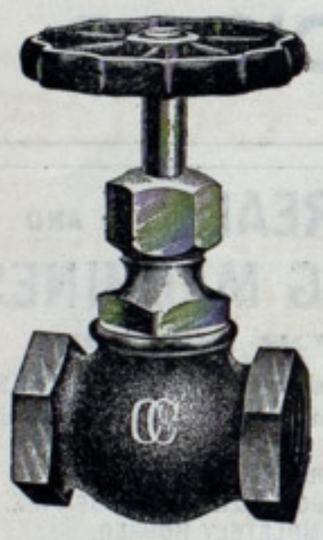
FOG WHISTLE MACHINES, HOISTING ENGINES,
STEERING ENGINES, AUTOMATIC TOWING ENGINES.
POWER AND DROP HAMMERS, AND OTHER MACHINERY
ENGINEERS' SUPPLIES, AND GENERAL JOB WORK.

TELEPHONE MAIN 994. 111 Elm Street CLEVELAND, OHIO.

Howard H. Baker & Co. SHIP CHANDLERS AND SAIL MAKERS,

18 to 26 Terrace, BUFFALO, N. Y.

GLOBE



No 1.

CRANE STANDARD BRASS VALVES

ARE GOOD FOR STEAM PRESSURES UP TO 100 LBS.

THEY ARE NOTED FOR THEIR UNIFORM EXCELLENCE IN DESIGN AND CONSTRUCTION. MAY BE PACKED WHEN VALVE IS OPEN AND STEAM IS ON. COMPARISON WILL EASILY INDUCE YOU TO

SPECIFY CRANE VALVES

WRITE FOR POCKET CATALOGUE

CRANE CO.

CHICAGO

ESTABLISHED 1855

NEW YORK
PHILADELPHIA
CINCINNATI
KANSAS CITY
SIOUX CITY
OMAHA

ST. PAUL
ST. LOUIS
LOS ANGELES
SAN FRANCISCO
PORTLAND, ORE.

ANGLE.

No. 2.

Ship Builders and Ships

SUPPLIED WITH ELECTRICAL APPARATUS

BY

Westinghouse Electric

& Manufacturing Co. Pittsburg. All Principal Cities in U. S. and Canada.

71 W

THE SCHERZER ROLLING LIFT BRIDGES.

Invented by William Scherzer, C. E. Patented.

NO CENTER PIER.

Now in Successful Operation:

One four-track Railroad Bridge for the Metropolitan Elevated Railroad Co., across the Chicago River.

One Highway Bridge for the City of Chicago, at Van Buren St., across the Chicago River.

One Highway Bridge for the City of Chicago, at North Halstead St.

For Railroads or Highways.

Entire channel available for navigation. No dock space wasted. Vessel owners will further their own interests by urging the adoption of this bridge over all navigable streams.

THE SCHERZER ROLLING LIFT BRIDGE CO., 1616 Monadnock Block, CHICAGO, ILL.

Varnish Paint made with gum begins to deteriorate from the moment of its application.

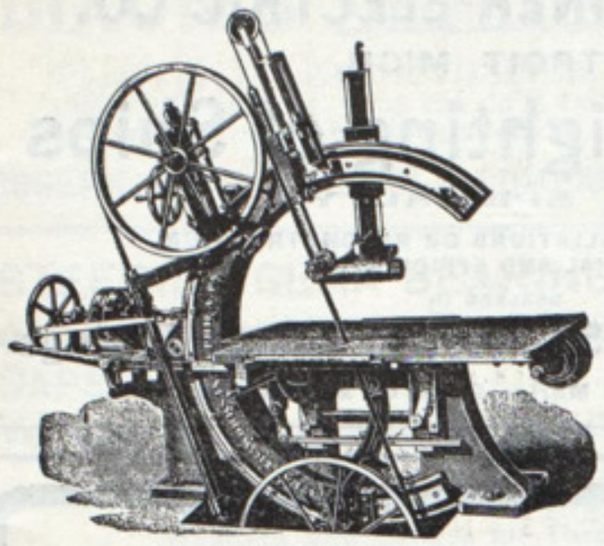
Our Varnish Paint Contains no Gum.

JOHN MAIR & SON. 136 S. Delaware Ave., PHILADELPHIA, PA.

CLEVELAND CITY FORGE & IRON CO.

CLEVELAND, O.

IRON OR STEEL FORGINGS FINISHED COMPLETE, ROUGH MACHINED OR SMOOTH FORGED ONLY, OF ANY WEIGHT
COUPLING LINKS AND PINS. PRESSED WROUGHT IRON TURNBUCKLES. CAR IRON SPECIALTIES.



ADJUSTABLE BEVEL BAND SAW.

Will bevel both ways to 45 degrees.
Power movement to change angles.
Power feed in three directions.

ESTABLISHED 1869. INCORPORATED 1896.

ATLANTIC WORKS INCORPORATED,

Successors to Berry & Orton Company.

2223-25-27 & 29 Arch St., PHILADELPHIA, PA., U. S. A.

MANUFACTURERS OF

MACHINERY FOR WORKING WOOD FOR USE IN SHIP YARDS, CAR SHOPS, RAILROAD SHOPS.

SEND FOR CATALOGUE. ESTIMATES FURNISHED.

Hollow Chisel Mortisers. Car Sill Dressers.

Thearle's Works ON SHIP BUILDING.

STANDARDS IN ENGLAND AND SCOTLAND

KNOWN AND USED WHEREVER STEEL SHIPS ARE BUILT.

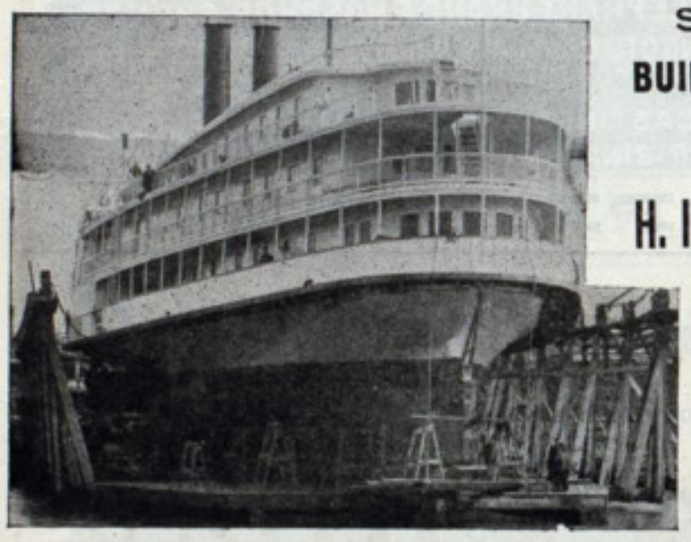
SEPARATE VOLUMES FOR PLATES.

"Ship Building in Iron and Steel." (Plates in separate volume.) $5.25.
"Ship Building and Laying Off." (Plates in separate volume.) $3.00.
"Theoretical Naval Architecture." (Plates in separate volume.) $3.50.
"Practical Naval Architecture." (Two volumes.) $3.00.

THE MARINE REVIEW PUB. CO., CLEVELAND.

BEST FORM OF DRY DOCK.

Crandall's Modern Marine Railways.



SAFE. RAPID.
BUILT OF STEEL OR WOOD
ANY SIZE.

H. I. CRANDALL & SON,

Contracting Engineers,

EAST BOSTON,
MASS., U. S. A.

AMERICAN LINE NEW YORK SOUTHAMPTON LONDON

CALLING AT CHERBOURG WESTBOUND.

Sailing From New York Every Wednesday at 10 A. M.

Steamers: ST LOUIS, ST PAUL, NEW YORK, PHILADELPHIA.

Special Express Train from **Southampton** to **London** in one hour and forty minutes.
Close connection at SOUTHAMPTON for **Havre** and **Paris** by special fast twin-screw Channel Steamers.

RED STAR LINE NEW YORK ANTWERP .... PARIS

Sailing Every Wednesday at 12 Noon.

Steamers: { **VADERLAND, *ZEELAND, KENSINGTON, SOUTHWARK, FRIESLAND.*

* New Twin-screw Steamers calling at Cherbourg eastbound.

One of the Shortest Routes to BELGIUM, HOLLAND, FRANCE, GERMANY, THE RHINE, SWITZERLAND and ITALY.

Send for "Facts for Travelers." International Navigation Company

Empire Building, 73 Broadway, New York.

305-307 Walnut St., Philadelphia.
Fiske Building, 89 State Street, Boston.
1306 F St., N.W., Washington, D. C.
Cor. Dearborn & Washington Sts., Chicago.
Third and Pine Streets, St. Louis.
10-12-14 Washington Ave., S., Minneapolis.
30 Montgomery St., San Francisco.

PIERS: 14 & 15 NORTH RIVER, FOOT OF FULTON ST., NEW YORK.

ILLUSTRATED NAUTICAL ENCYCLOPEDIA A WORK IN ALL RESPECTS UP TO DATE.

By HOWARD PATTERSON, Principal of New York Nautical College.

ORDER NOW. IT IS IN PRESS.

Not a Dictionary of Sea Terms alone. It is complete from the standpoint of the Naval Architect and Marine Engineer.

PUBLISHED BY THE MARINE REVIEW PUB. CO., CLEVELAND, O.

NOW READY 200 PAGES

SEND 3 CENTS FOR OUR

NEW CATALOGUE

OF BOOKS ON

MARINE, ELECTRICAL, MECHANICAL

ENGINEERING.

BE SURE TO WRITE CLEARLY YOUR FULL ADDRESS.

SPON & CHAMBERLAIN,

12 Cortlandt Street, NEW YORK, U. S. A.

ELECTRIC AUTOMATIC WHISTLE OPERATOR will operate whistle from any distance with ease and certainty.

WHISTLE BLAST RECORDERS will prove invaluable in cases of collision or grounding through crowding or other causes. STEAM SHIP WHISTLES in all sizes to operate with steam or air. It will pay you to investigate our novel improvements. Catalogues mailed to captains, owners or engineers, upon application.

THE SIGNAL & CONTROL CO., 24-27 WEST STREET NEW YORK, U. S. A.

Chas. E. & W. F. Peck,

58 William Street, NEW YORK CITY.
C. T. BOWRING & CO., Ltd. 5 & 6 Billiter Ave., London, E. C., Eng AND AT LLOYDS, LONDON.
Royal Insurance Bldg., CHICAGO, ILL.

INSURANCE

ALL CLASSES OF MARINE INSURANCE, BOTH CARGOES AND HULLS.

GREAT LAKES REGISTER

INCORPORATED

COMBINED AND ISSUED IN CONNECTION WITH THE

BUREAU VERITAS

INTERNATIONAL REGISTER OF SHIPPING.

GREAT LAKES REGISTER DESIRES TO ANNOUNCE THAT ITS RATINGS GO BEFORE THE LEADING UNDERWRITERS OF AMERICA ENGLAND AND FRANCE.

THE SERVICES OF ITS SURVEYORS MAY BE ENGAGED ON HULL AND CARGOES.

F. D. HERRIMAN, SURVEYOR GENERAL,
320-322 PERRY-PAYNE BUILDING, CLEVELAND O

THE CHAMPION RIVET CO.

Government Work a Specialty

Quality: Highest Standard. Finish: Unexcelled.

CLEVELAND, O., U. S. A.

VICTOR BOILER AND STRUCTURAL RIVETS.

SEIDLER-MINER ELECTRIC CO.

DETROIT, MICH.

Electric Lighting of Ships

OUR SPECIALTY.

COMPLETE INSTALLATIONS OR RECONSTRUCTION, SAFE, SUBSTANTIAL AND EFFICIENT.

DEALERS IN

Marine Electrical Supplies AND Special Fittings.

Catalogue and Marine Rules on application.

THE "WOOTTERS" GASOLINE MARINE ENGINES

Launch W. C. RICHARDSON.

Built for Hausheer & Sons, Cleveland, O. Dimensions, 35 x 8 O. A. Engine 8 horse power.

ALWAYS RELIABLE.

Especially adapted for Launches, Fish Tugs and Ferry Boats.

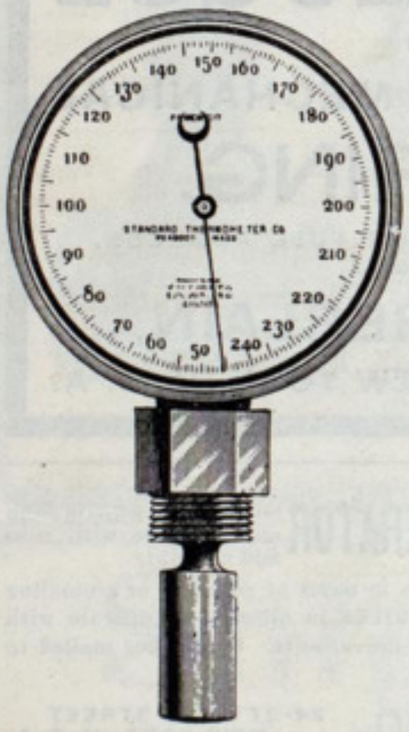
Catalogue, Prices and Particulars furnished on application.

Engines of the Stationary Type built suitable for all purposes requiring from 4 to 100 horse power, where a reliable and efficient power is required.

ENGINES BUILT BY

CHASE MACHINE CO.,

CLEVELAND, O.



Helios-Upton Co.

PEABODY, MASS.

Hot Water Thermometers and Thermometers for Mechanical Purposes.

Used by U. S. Navy in all New Ships.

Eighty of them furnished the Japanese Cruisers "Kasagi" and "Chitose."

SEND FOR BULLETIN No. 40 A.

The Bessemer Steamship Company

Solicits Catalogues, Prices and Discounts from manufacturers and wholesale dealers in Ship Machinery, Brass Goods, Rope, Paints, Asbestos, Packing, Hose, Furniture, Piping, Glass and Crockery, Tinware, Ranges, Carpeting, Bedding, Life-Preservers, Rafts and Boats, Engineers' Supplies and Tools, Carpenters' Tools, Electric Supplies, Lamps, Grate Bars, Castings, etc., etc., etc.

ALSO QUOTATIONS from Market men and Grocers on the Lakes for Provisions and Meat, best quality only.

CATALOGUES without quotations are not wanted.
ALL GOODS except provisions to be delivered in Cleveland.

Address L. M. BOWERS, General Manager,
CLEVELAND, OHIO.

DELTA METAL

REG TRADE MARKS "Phosphor-Bronze" DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED, 2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE RODS, SHEETS, ETC.
—DELTA METAL—
CASTINGS. STAMPINGS AND FORGINGS.
ORIGINAL AND SOLE MAKERS IN THE U.S.

PROPELLERS.

The Martin-Barriss Co.

IMPORTERS AND MANUFACTURERS OF

Mahogany, White Mahogany,

AND ALL NATIVE CABINET WOODS.

HIGH GRADES OF KILN DRIED WOODS FOR CABIN WORK AND INSIDE TRIM.

White Oak Timbers and Plank,

CONSTANTLY ON HAND AND SAWED TO ORDER ON SHORT NOTICE.

654 Seneca Street, Cleveland, O.

MacKinnon Manufacturing Co.

Boiler Makers, Founders and Machinists.

Marine Boilers, Engines and Shipyard Machinery. Most powerful set of Hydraulic Slings on the Lakes. Best Towing and Speed Propeller Wheels made.

SPECIALTY SMALL YACHT WHEELS.

Works and Office, 224-230 N. Water Street. BAY CITY, MICH.

S. F. HODGE & CO.

MARINE ENGINES,
PROPELLER WHEELS,
DECK HOISTERS,
MARINE REPAIRS.

320 ATWATER STREET,
DETROIT, MICH.

DIXON'S GRAPHITE PIPE JOINT COMPOUND

Enables you to MAKE A TIGHTER JOINT than you can possibly make with red lead. You can do it easier, and parts can be separated at any time without breaking anything. Send for sample and circular.

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

DIXON'S Lubricating Graphite

Is fully explained in an INTERESTING AND INSTRUCTIVE PAMPHLET which is FREE to all interested. It will pay all Engineers and Machinists to SEND FOR IT.

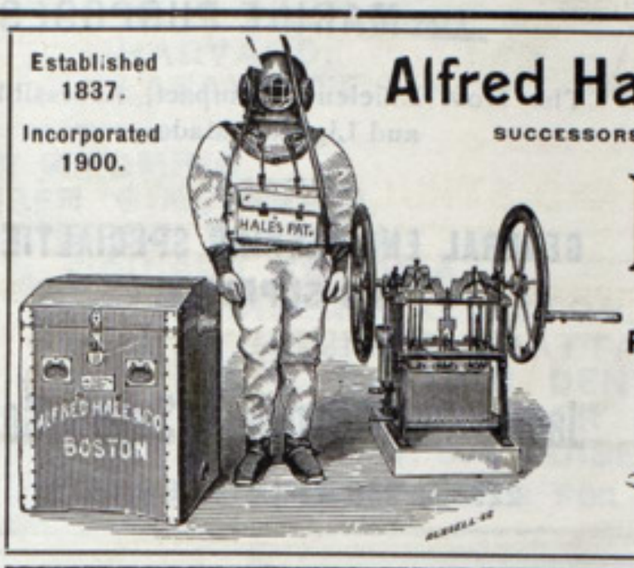
JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

STEERING GEAR BEARINGS,
AMMUNITION HOIST BEARINGS,
CAPSTAN BEARINGS,
WINDLASS AND WINCH BEARINGS,

REQUIRING NO OILING OR GREASING.

Also Anchor, Davit and Cargo Block Bushings, Bushings for Sheaves on Wrecking Derricks, Washers and Collars for Thrust Bearings.

THE GRAPHITE LUBRICATING CO.,
BOUND BROOK, N. J., U. S. A.



Established 1837.
Incorporated 1900.

Alfred Hale Rubber Co.

SUCCESSORS TO ALFRED HALE & CO

DIVING APPARATUS
OUR SPECIALTY.

Repair Cloth.
Rubber Cement.

OFFICE AND FACTORY:
387 E. Eighth St.,
SO. BOSTON, MASS.

Pure Feed Water.
Clean Boilers.
Lower Fuel Bills.

Reynolds Feed Water Heater and Purifier

Suited to both Marine and Stationary Boilers.

Prevents formation of scale, removes old scale, and reduces fuel bills.

In use on a number of steam vessels on the Great Lakes.

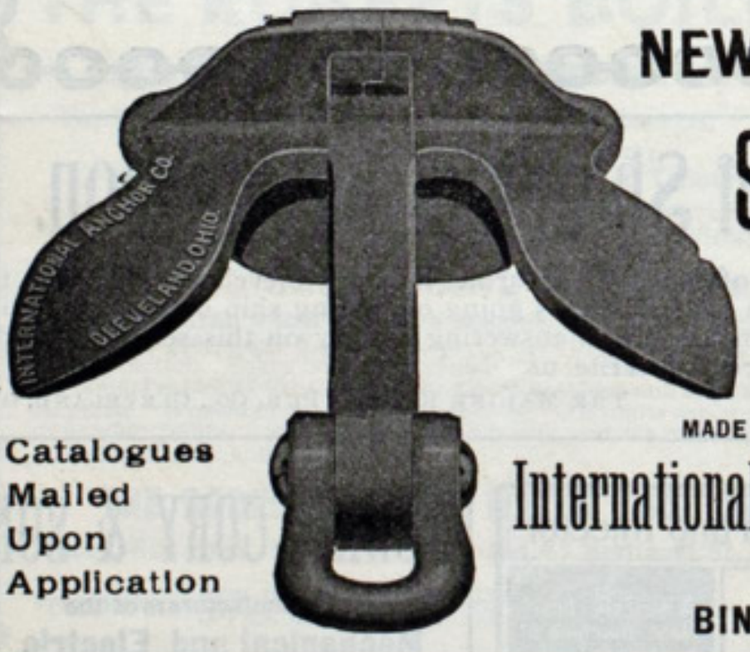
H. J REYNOLDS,
721 PERRY-PAYNE BLDG.,
CLEVELAND, O.

THE MARINE DEPARTMENT

of the Geo. F. Blake Mfg. Co. take pleasure in announcing that they were awarded the Grand Prix at the recent Exposition at Paris, for their special exhibit of Marine Pumps, Condensers, etc.

Send for new Catalogue of Marine Specialties.

THE GEO. F. BLAKE MFG. CO., 91 Liberty St., N. Y. City.



NEW PATENT STOCKLESS ANCHOR

Catalogues Mailed Upon Application

MADE BY THE
International Anchor Co.
CLEVELAND, O.
BINGHAMTON, N. Y.

HENRY R. WORTHINGTON, PUMPING MACHINERY.

MARINE AIR AND FEED PUMPS
A SPECIALTY.

WATER METERS.

BOSTON. CHICAGO. PHILADELPHIA. ST. LOUIS. BUTTE.

CLEVELAND. PITTSBURG. ATLANTA. SAN FRANCISCO NEW ORLEANS.

120 Liberty St., NEW YORK.

ELASTIC SEAM-COMPOSITION
TRADE MARK

For Decks and all other Seams,
Weather Checks,
Floors, Skylights, Etc.

AND **ELASTIC SEAM PAINT**
WHITE, BLACK AND COLORS,
IS BEING USED BY

U. S. ARMY TRANSPORTS, AMERICAN LINE, ATLAS LINE,
OCEAN STEAMSHIP CO., OLD DOMINION STEAMSHIP CO.,
FIRE BOAT NEW YORKER, PANAMA RAILROAD STEAMSHIP CO.
L. BOYER'S SON'S TRANSPORTATION CO.,
NEW YORK & CUBA MAIL STEAMSHIP CO., (WARD LINE,)
MERRITT & CHAPMAN D. & W. CO. PENNSYLVANIA RAILROAD CO., ETC.

TO BE BOUGHT OF
Anthony S. Morse, 210 Commercial St., Boston.
Cook & Co., Tacoma, Wash.
Jennison Hardware Co., Bay City, Mich.
J. F. Donahue & Co., Sandusky, O.
The Chas. F. Beebe Co., Portland, Ore.
Geo. B. Carpenter & Co, Chicago, Ill.
Elisha Webb & Sons, 108 S. Delaware, Philadelphia.
H. Steffens, 337-339 Fell St., Baltimore.

And all marine hardware stores in New York and Brooklyn.

Samples sent on receipt of 30 cents in stamps. An agent wanted in each seaport town.

COLE & KUHLS, Sole Manufacturers,
Office and Factory, foot of 24th St. [Mention this Paper.] BROOKLYN, N. Y.

BALDT PATENT STOCKLESS ANCHOR

Made of the finest quality of open-hearth steel, and constructed on the ball and socket principle. Many points of superiority over ordinary stockless anchors.

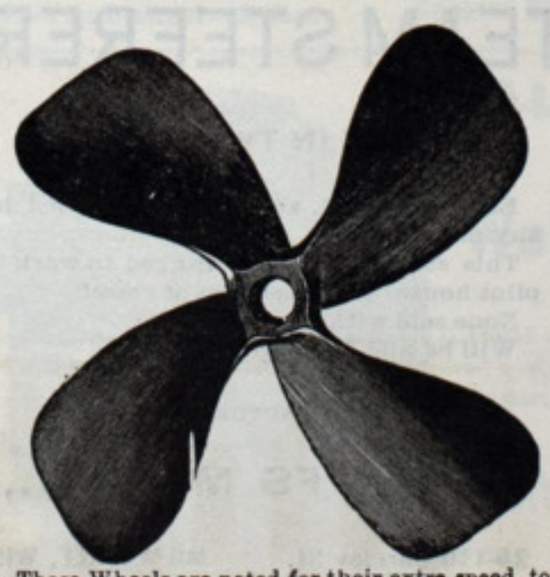
BALDT ANCHOR COMPANY,
CHESTER, PA.

WALTER MILLER PERRY-PAYNE BUILDING, CLEVELAND, O.

Representative for the Great Lakes. We keep a large number of Anchors in stock.

H. G. TROUT.
KING IRON WORKS,
BUFFALO, N. Y.

MANUFACTURERS OF



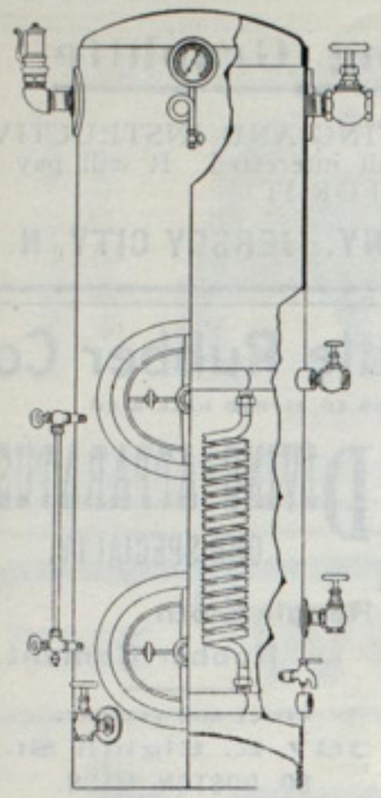
TRIPLE EXPANSION, FORE-AND-AFT AND STEEPLE COMPOUND MARINE ENGINES,

High and Low Pressure Engines,
Sectional Propellers,
Tug and Yacht Wheels.

Cowles Aluminum and Manganese Bronze Propeller Wheels.

These Wheels are noted for their extra speed, towing power and proportionate saving of coal.

Prices Quoted on Application.



Evaporating and ... Distilling Apparatus

FOR **MARINE PURPOSES.**

The Most Efficient, Compact, Accessible and Lightest Made.

GENERAL ENGINEERING SPECIALTIES AND SUPPLIES.

James Reilly Repair & Supply Co.,

229 and 230 West St., NEW YORK.

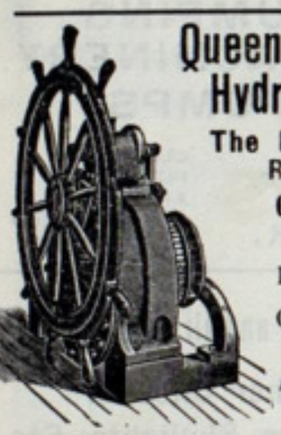
SIXTH REVISED EDITION.

Scott's Coast Pilot for 1901.

Great Lakes and Connecting Waters,

AT $1.50.

For sale by MARINE REVIEW PUB. CO.



Queen City Patent Hydraulic Steerer.

The Best and Most Reliable.

Generates No Heat In Pilot House

Has Large Hand Wheel.
Can be Changed from Power to Hand Steering Instantly.
A Favorite with Pilots.
Send for References.

Queen City Engineering Co., Buffalo, N. Y.

ALFRED B. SANDS & SON

MARINE PLUMBERS
AND MANUFACTURERS OF
Marine Plumbing Specialties.

Marine Water Closet for either above or below water line.
Folding Lavatories, Ventilators, Pumps, Tanks, &c., &c.

134 BEEKMAN ST., NEW YORK.

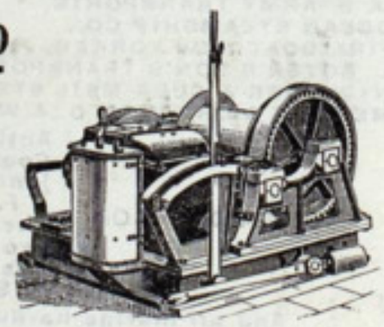
LIDGERWOOD IMPROVED

HOISTING ENGINES.

OVER 17,500 IN USE.

ELECTRIC HOISTS

Specially adapted for Docks, Warehouses and Steamships.....



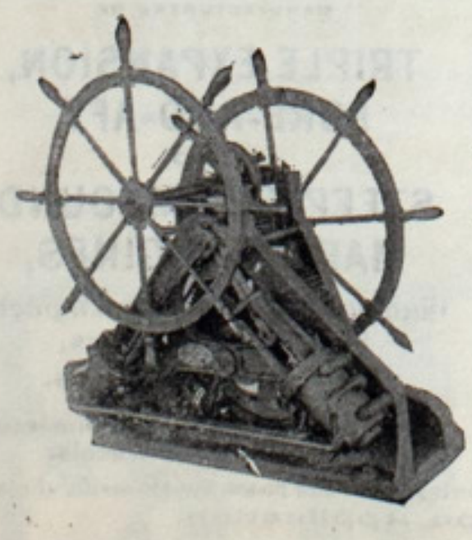
Simple, Light and Compact.

SEND FOR CATALOGUE

LIDGERWOOD MFG. CO.,

96 Liberty Street, NEW YORK.

SHERIFFS STEAM STEERER



MADE IN TWO SIZES.

Easy to adjust, and can be handled by any one.
This steerer can be arranged to work in pilot house or in after part of vessel.
None sold without a quadrant.
Will be sold on approval.

MANUFACTURED BY

SHERIFFS MFG CO.,

26-130 Barclay St. MILWAUKEE, WIS.

THE TOPOPHONE

$25.00

Prevents Marine Disasters in Fogs.

Write for circular to

J. B. COLT CO.,

Room 7, 21 Barclay St., N. Y.

MARINE CHAIN

OF ALL KINDS.

Ships Cables, Dredge Chains,
Stud Link and Marine Railway Chains,
Steam Shovel Chains, Boom Chains, Etc.

CERTIFICATE OF TEST FURNISHED.

STANDARD CHAIN CO.

PITTSBURGH, PA.

Bureau of Shipping Information.

Such is the office of the Marine Review, Cleveland. We try to keep in touch with all that is going on among ship owners and ship builders and never tire of answering inquiry on this score from advertising patrons. Write us.

THE MARINE REVIEW PUB. CO., CLEVELAND, O.

Sellers' Restarting Injector

A strictly first class machine at moderate cost.

Perfectly automatic, has wide range of capacities, and raises water promptly with hot or cold pipes.

Very simple, has few parts and is easily repaired.

All parts interchangeable, made of the best bronze, and the workmanship is perfect. Send for special catalogue descriptive of this Injector.

JENKINS BROTHERS, Selling Agents
NEW YORK, BOSTON, PHILA., CHICAGO

CHAS. CORY & SON,

Manufacturers of the
Mechanical and Electric Marine Telegraph,

Electrical Helm Indicators
Electric Call Bells.

Engine Bells and Brass Work of all descriptions, Shrieking and Siren Whistles.

278 DIVISION ST.,
NEW YORK CITY.

THE BABCOCK & WILCOX CO.

HAVE EQUIPPED THE FOLLOWING LAKE VESSELS WITH THEIR FORGED STEEL WATER TUBE BOILERS:

ZENITH CITY,
QUEEN CITY,
EDNA G.,
CRESCENT CITY,
SUPERIOR CITY,
EMPIRE CITY,
ALEX McDOUGALL,
PRESQUE ISLE,
MATAAFA,
MAUNALOA,
MALIETOA,
JOHN W. GATES,
JAMES J. HILL,
ISAAC L. ELLWOOD,
WM. EDENBORN,
W. S. GRATTAN,
HARVARD,
LAFAYETTE,
CORNELL,
PRINCETON,
RENSSELAER,
PARAGUAY,
ASUNCION.

BOILERS NOW UNDER CONSTRUCTION FOR U. S. MONITOR WYOMING,
U. S. CRUISER CINCINNATI,
U. S. CRUISER RALEIGH,
U. S. CRUISER TACOMA,
U. S. CRUISER GALVESTON,
U. S. CRUISER CHATTANOOGA,
U. S. CRUISER DENVER,
U. S. CRUISER DES MOINES,
U. S. CRUISER CLEVELAND,
AND SEVERAL LARGE VESSELS FOR THE PACIFIC COAST.

The Babcock & Wilcox Co.,
85 LIBERTY ST.,
NEW YORK.

THE BUFFALO DRY DOCK CO.

GANSON STREET AND BUFFALO RIVER.

Operating Four Docks, Sixty-ton Shear Legs, and in every way Equipped

WITH MODERN MACHINERY FOR

Prompt and Economical Repairs

AND FOR THE BUILDING OF STEEL AND WOODEN SHIPS.

OFFICE, GANSON ST., TELEPHONE 515 SENECA.

Edward Smith, President, Tel. 279 Seneca.
Edward Smith, Residence Tel. 209 Bryant.
Geo. B. Drake, Ass't to President, Residence Tel. 798 Bryant.

THE ROBERTS BOILER CO.

HAS BUILT OVER 1000 BOILERS TO DATE

For Launches, Yachts, Passenger and Freight Steamers,
Dredges, Tugs, Stern-wheelers, Canalers;
Also for Navy Department, War Department, Treasury Department,
Light-House Board and Revenue Cutter Service;
Also for N. Y. Dock Department and U. S. Supervisor, Harbor of N. Y.

SAFETY AND ECONOMY.

NEVER KILLED A MAN OR HAD A SERIOUS ACCIDENT. $250,000 capital. Works covering 29,000 square feet of ground. Never had a boiler returned on account of dissatisfaction. Every boiler warranted. All material made specially for our use. All boilers tested at 500 pounds hydrostatic pressure and 250 pounds of steam before shipping. Workmanship strictly first-class. All joints screwed and reliable. No expanded joints. State your requirements and we will furnish specifications. Correspondence solicited.

THE ROBERTS SAFETY WATER TUBE BOILER CO.,

Works, Red Bank, N. J. 39 and 41 Cortlandt St., NEW YORK CITY.

TELEPHONE: { NEW YORK OFFICE, 599 CORTLANDT. / OFFICE OF WORKS, 49 RED BANK, N. J. } Cable Address, "BRUNIVA, NEWYORK."

ALL THE NAVIES OF THE LEADING GOVERNMENTS OF THE WORLD USE

The Niclausse Water Tube Boiler,

ADOPTED BY THE NAVIES OF

UNITED STATES,
ENGLAND,
FRANCE,
RUSSIA,
ITALY,
GERMANY,
SPAIN,
Argentine Republic,
CHILI.

We have now in course of construction at our Works 60,000 H. P. Niclausse Boilers for the following war vessels:

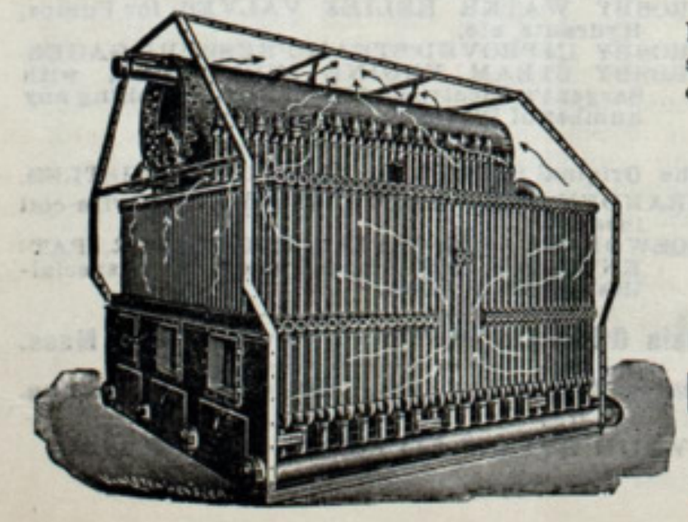
U. S. Monitor CONNECTICUT, { Building at the Ship Yard of the Bat Iron Works, Bath, Me.

U. S. Battleship MAINE,
Russian Battleship RETVIZAN,
Russian Cruiser VARIAG, { Building at Wm. Cramp & Sons Ship Yards, Philadelphia.

THE STIRLING COMPANY,

Write for Descriptive Matter. General Offices Pullman Building, Chicago, Ill.

THE "TAYLOR" YACHT BOILER



Has held the record three seasons on the fastest yacht on the great lakes.

Guaranteed against Rupture of Tubes.

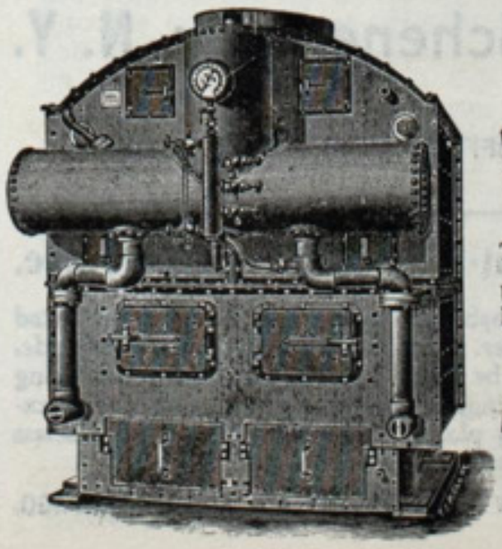
Will not Prime in the Roughest Sea.

MANUFACTURED BY

Detroit Screw Works,

FOOT OF REOPELLE ST.,

DETROIT, MICH., U. S. A.



ALMY'S PATENT

SECTIONAL

Water Tube Boilers.

NOW USED IN

Thirty Passenger Boats and 100 Steam Yachts ranging from 50 to 250 feet in length,
U. S. Torpedo Boat "Stiletto."
Numerous Small Launches and Stationary Boiler also giving most excellent results.

ALMY WATER-TUBE BOILER CO.,

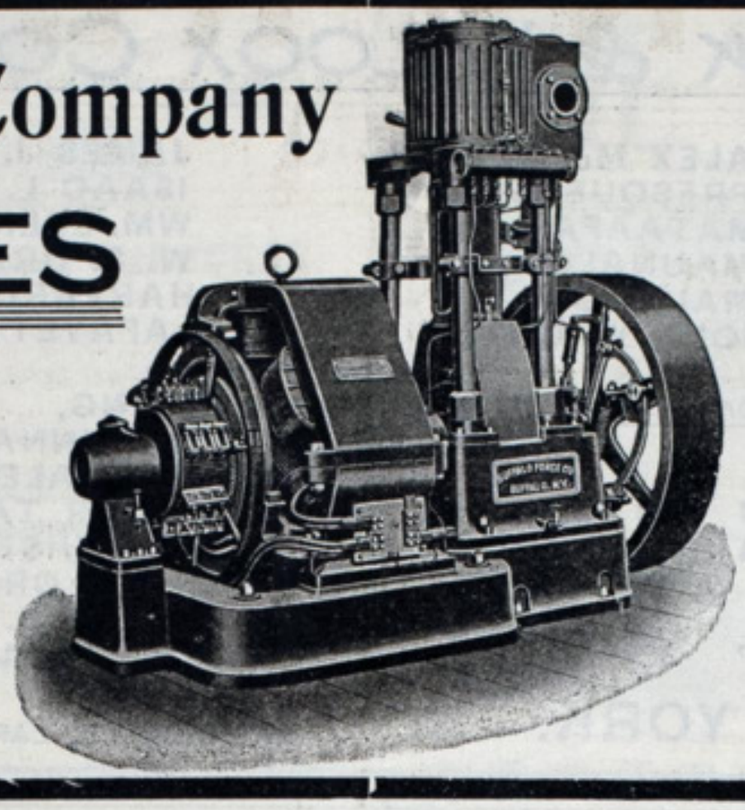
178-184 Allens Avenue,
near Rhodes St.

PROVIDENCE, R. .

Buffalo Forge Company

ENGINES

FOR
MARINE
LIGHTING SETS



COMPACTNESS
DURABILITY
ECONOMY
ACCESSIBILITY

Buffalo Forge Company,
BUFFALO, N. Y.

The Shipowners Dry Dock Co.

CHICAGO.

Repairs to Steel and Wooden Vessels. | **Three Docks at Halsted Street and North Branch.**

OFFICES, 21 AND 23 SHERMAN STREET.

OFFICE TELEPHONE, HARRISON 1020.
YARD TELEPHONE, NORTH 759.

W. W. WATTERSON, SUPT.

ASHTON

CAM LEVER POP SAFETY VALVES
AND NON-CORROSIVE STEAM GAGES
give highest efficiency and durability. Specify them and get the best.

THE ASHTON VALVE CO., BOSTON, NEW YORK AND CHICAGO, U. S. A.

GENERAL ELECTRIC COMPANY'S

SIGNAL LANTERN.

Electrical Signalling Apparatus

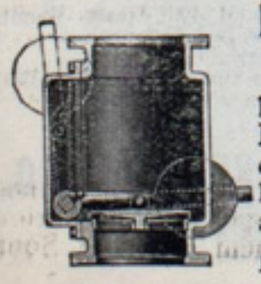
FOR USE WITH INTERNATIONAL AND NAVAL CODE.

Write for Catalogue 1025.

General Office,
Schenectady, N. Y.

SALES OFFICES IN ALL LARGE CITIES.

Excelsior Straight-Way Back Pressure Valve.



This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well-made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

JENKINS BROTHERS. NEW YORK. PHILADELPHIA, BOSTON, CHICAGO.

THE BOURNE-FULLER CO.

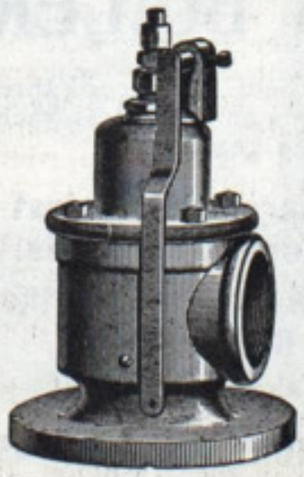
CLEVELAND O.

BAR IRON. **PIG IRON.**

ARCHES AND STRAPS FOR WOODEN VESSELS.

BOILER RIVETS. BOILER TUBES. BRACE IRON.
IRON AND STEEL SHEETS. MACHINERY AND TOOL STEEL.
BESSEMER AND OPEN HEARTH STEEL.
SHIP PLATES, BOILER PLATES, SHIP RIVETS.
BEAMS, CHANNELS, ANGLES, BARS, AND OTHER SHAPES.
BILLETS, BLOOMS AND FORGINGS.
"BYERS" FULL WEIGHT WROUGHT IRON PIPE.

CROSBY STEAM GAGE AND VALVE CO.



CROSBY POP SAFETY VALVES, Locomotive, Marine and Stationary.
CROSBY WATER RELIEF VALVES, for Pumps, Hydrants, etc.
CROSBY IMPROVED STEAM PRESSURE GAGES
CROSBY STEAM ENGINE INDICATORS, with Sargent's Electrical Attachment for taking any number of Diagrams simultaneously.

The Original SINGLE BELL CHIME WHISTLES.
BRANDEN PUMP VALVES; rubber with wire-coil insertion.
BOSWORTH FEED-WATER REGULATOR, PATENT GAGE TESTER, and many other specialties in Steam Lines.

Main Office and Works: Boston, Mass.

Stores; Boston, New York, Chicago, and London Eng.

WE WILL REPAIR YOUR STEAM FITTINGS PROMPTLY.